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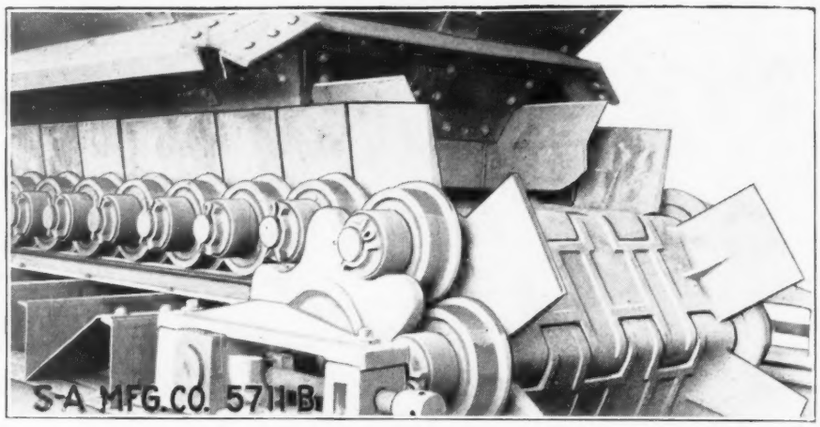

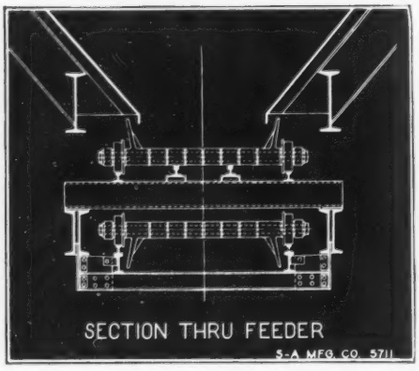

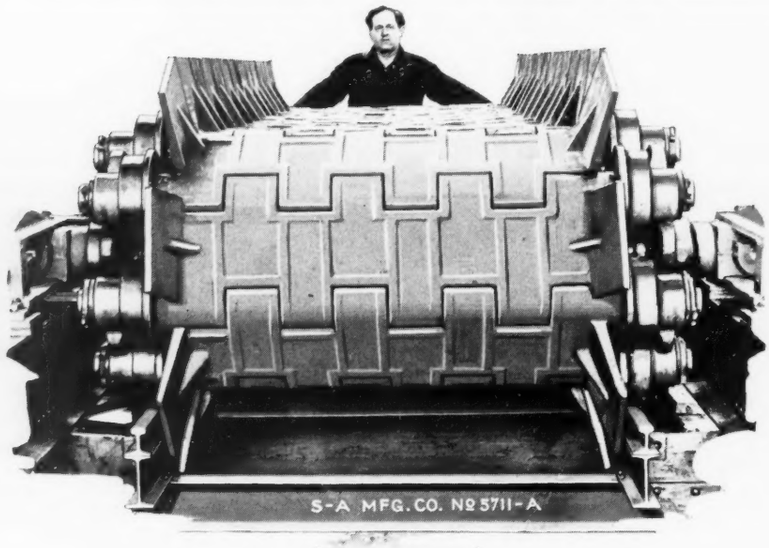

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Flotation Nomenclature

GRANTING that the function of words is to facilitate the accurate communication of ideas, the principal desideratum in the use of expressions of a special technical character is that every one who is interested in the subject shall understand what is meant. If the words are appropriate and significant, the chief aim should be to employ each to mean the same thing throughout an industry. It is desirable, if practicable, to avoid the interchangeable use of two words to describe a single type of process.

A plausible argument can be advanced for the use of either of the terms "selective" or "differential" to designate the kind of flotation practiced at Kimberley, B. C.; at Midvale, Utah; and in the Chihuahua district in Mexico: that is, the production of two or more sulphide concentrates from a so-called complex ore. It can be argued that "selective" is a good word because it contrasts with "collective"—used to denote the making of a single concentrate designed to contain two or more sulphides. On the other hand, it may be said that "differential" implies a greater degree of nice discrimination than does "selective," and that, as the separation of two sulphides is based on a critical adjustment of reagents, manipulation, and conditions, "differential" is the better term. As a matter of fact the choice is purely arbitrary. All flotation processes are selective, all are preferential, all are differential: otherwise there would be no separation. Incidentally, the same may be said of the operation of a Wilfley table or a magnetic concentrator.

More than a year ago *Engineering and Mining Journal* proposed that the term "selective" be used where two or more marketable concentrates were produced; and that "differential" be reserved to describe a process in which one sulphide is floated while another sulphide in the ore is made to remain in the tailing by the use of depressing reagents or by other purposeful procedure. This is done at Garfield, Utah; and at Cananea and Nacozari, in Mexico.

Many have adopted this plan; others apparently have not. At any rate, considerable literature has accumulated in which "selective" has been the accepted term. In the interest of uniformity in the nomenclature of flotation, it is now felt that it would be well if "selective" could be used generally; under the head of "selective" flotation might well be included any operation in which an essential feature was a separation of two sulphides. At Britannia Beach, two concentrates are made, one of copper, another of iron. That procedure is selective flotation. At Garfield it would be easy to recover in like manner a concentrate by floating the tailing from the regular copper circuit. The fact that this is not done should not exclude the primary flotation from the category of "selective." At Anaconda, collective flotation produces a two-metal concentrate, which is subjected to selective flotation to effect a separation of the two predominant sulphides.

In the exceptional case where only one sulphide is present in the feed in sufficient quantity to be given consideration, the treatment would be straight flotation. If the recovery of secondary sulphide or sulphides be desired in the concentrate, the process would be "collective"; if they be desired in the tailing, the process would be "selective." If, at any stage in the treatment, selective work were to be done, the operation of the plant would be one of selective flotation. Comment on this proposal by interested engineers is invited.

Mining at Home and Abroad

A CORRESPONDENT writes deploring the investment of American capital in mining ventures abroad, but it is believed that the subject is worthy of more study than has been given to it in this instance. The flow of capital away from this country cannot be stemmed by words, and *Engineering and Mining Journal* sees no logical reason why an obvious outlet for investment, equipment, and technical skill should be barred to the industry and profession that it has the privilege to represent. The earmarking of loans abroad for specific purpose, to encourage the utilization of the services of American engineers and the sale of American equipment, is a requirement on which there can be no two opinions outside banking circles in this country. That on occasion partiality has been shown in the development of a foreign rather than of a domestic deposit may not be doubted; but this can offer no reason for the adoption of an insular policy in regard to all mining enterprise beyond our own borders.

It is misleading to state or to infer that domestic mining suffers because of the diversion of funds abroad. Ample money, and more, is available for the domestic expansion of the mining industries. The task is to provide the data that will convince the investor, and no good will be done by casting doubts on his patriotism. If patriotism can be measured in inverse ratio to this country's total investments abroad in recent years, it is obvious that the situation is beyond recall. It is absurd to suggest, moreover, that American industry goes abroad to exploit cheap labor, to the disadvantage of the domestic producer. Those with any experience know that such help is the most expensive in the long run, especially when pampered by illogical social laws. It is easy to hint immorality in the development of an overseas deposit, as measured by an equally decreased production at home. But would any member of our mining profession, for instance, wish that a foreign power had control of the great copper deposits of Chile? Is it not possible logically to view such projects as have been launched in that

country as commendable and patriotic, as evidence of superior acumen and foresight and as leading to the development of technical methods that have provided inspiration and material help in the launching of similar projects at home? The Anaconda company, as an example, is operating in Poland as well as elsewhere abroad. However, it is also to be credited with contemporaneous activity in the Park City district of Utah, in the Tintic district of Utah, in the Rico district of Colorado, and in Idaho. The sending of capital to Poland has not in any way curtailed the extent of its interest and participation in the development and financing of new mining ventures in the United States.

The subject is a large one, with much to be said pro and con. As a nation possessing ample funds for domestic development and also for expansion in the foreign field, an insular policy would not seem to be a wise one. No field abroad must be closed to our engineers and our manufacturers.

Reaching the Responsible Men in Industry

WHAT do titles signify in a mining organization? The outside business world frequently wants to know. In general it may be answered that they furnish a poor guide to an understanding of real responsibilities. "Manager," "superintendent," "engineer," "foreman"—these and others are used with a looseness that may mislead. When to these is added the list of company officers, the manufacturer often finds it hard to guess with whom it is best to deal.

As one star differs from another star in glory, so do superintendents vary in importance. The "manager" at times has slight authority save in hiring men. In places he may have a varied staff, to whom he leaves the decision as to selection of equipment; elsewhere he may combine within himself the function of all these individuals. Titles, moreover, may be of an honorary sort, serving perhaps in lieu of larger salaries. They may even serve a less justifiable purpose, as at a quondam plant, of 600 tons' daily capacity, which after years of operation with a superintendent and two foremen suddenly blossomed into a 1,000-ton plant, with a manager and two superintendents (the same individuals as before). The addition to the mill feed of 400 tons of waste per day caused the change!

Titles, in short, mean little. The real index of an operating official's position is the actual responsibility that he has. It is this that should interest the outside business world in its dealings with a mining company. To the salesman, this knowledge is a matter of importance, for it has a bearing on his sales, in that it will indicate the contacts he ought to make.

Unfortunately for the salesman, he does not find it easy in every instance to make the desired contacts. Often he gets no closer to the individuals who have voice in the actual selection of equipment than the purchasing agent. The operating officials can be found only by searching through the plant or going underground—a course that the average mining company does not regard with favor. Furthermore, these individuals are often several in number, and a conference with them all collectively is impossible to arrange, save in rare instances. It would be excellent for the mining company if such contacts and conferences between its key men and salesmen were practicable and feasible. Invariably the salesman has information of value to impart, even though no actual sale be made. The debt that the mining industry owes the manufacturer, or, better, to the developer of the equipment that it uses, is difficult to estimate. It is exceedingly large. In many instances, with the aid of a well-organized technical staff, the manufacturer has made significant contribution to mining and metallurgical progress.

It is apparent, therefore, that an intimate contact between the developer and the user of industrial equipment is needed, but that personal contact cannot usually be made. It is here that the technical press performs one of its several functions by providing means for the desired contact. Through its pages, both editorial and advertising, announcement of new developments, new inventions, and new applications of industrial equipment can be, and is, carried to the user and prospective user.

The enormous development in American industry in the last quarter of a century and the vast increase in national wealth have been paralleled in the same period by the phenomenal development in the United States of the technical journal. Until its advent, industry consisted of many scattered units, each unit, each plant, and each organization being little known to the others. That was the day of secrecy and suspicion, when exchange of information was seldom practiced in business. The plant door or the inclosure gate was shut to the outside world. Conditions changed when the representative of the technical press succeeded in getting past this barrier, into the plant and office, and persuaded the operator to allow the information to be published. The practice grew, industry's treasured secrets were broadcast to the world, and competitors mutually profited. As the common fund of knowledge increased, discovery and invention followed with phenomenal rapidity; industry grew and the national wealth grew with it. This, in epitome, is the story of American industry.

Economic Forecasters Are Optimistic

PREPONDERANCE of expert opinion among the economists is that the general business outlook today is better than it has been for six months. These views may be influenced by habitual optimism or perhaps by the spirit of the approaching holiday season; but the sign posts that are usually reliable guides seem generally favorable. High wages and the absence of unemployment; better crops or higher prices for farm products; small stocks of goods and the absence of inflated prices; and low interest rates and a generally satisfactory condition of the financial structure indicate expansion rather than depression in business.

There is no denying that in the aggregate the record for 1927 will show a moderate contraction in the scale of productive activity, compared with 1926. Textiles, rubber, leather, and lumber have been very active; but automobile production will be off about 15 per cent—influenced largely by the temporary shutdown of the Ford plants; and steel output will show a decline of about 7 per cent. Reflecting about the same degree of lessened activity are the accompanying figures comparing the apparent domestic consumption of the major non-ferrous

metals for corresponding periods in the last three years.

A significant fact, however, is that the figures for 1927, though under those for 1926, exceed those for 1925 by a wide margin. And 1925 was a highly prosperous year. In other words, the consumption of metals in 1927 has been good and the rate of productive activity at the mines has been high. The decline in prices has not been the consequence of serious contraction in industrial demand; but because of high rates of production. As in steel and other industries, severe competition in selling has caused an approach to a condition aptly described as "profitless prosperity."

Apparent Domestic Consumption of Metals

	1925	1926	1927	Decline, Per Cent
Copper (10 months)	677,000	766,000	705,000	8.1
Zinc (10 months)	430,000	484,000	459,000	5.6
Lead (9 months)	473,000	544,000	524,000	3.5

From the standpoint of the metal producer the outlook for 1928 pictured by the business forecasters holds much of encouragement. They maintain that after the phenomenally active year of 1926 a modest recession has been a good thing. The lull has tended to clear the way for a subsequent revival. Industry has had a chance to recover its breath. If producers and sellers of metal will take advantage of their experience in 1927, next year should be a good one, particularly if the more optimistic of the economic physicians are right in their diagnosis and an expansion of some consequence takes place in the scale of consuming activity.

Significant Cable Development Promises Wider Use of Electric Power

TRANSMISSION of electric current underground at 220,000 volts is forecast in the announcement made at a meeting of the American Institute of Electrical Engineers, at Chicago, recently, of a new type of conduction cable, the feature in which is that it possesses a continuous core filled with oil. Customary practice to date involves the use of a cable consisting of a multitude of woven copper wires, insulated from an outer lead sheathing. The substitute now proposed and proved by the New York Edison-United Company and the Commonwealth Edison Company carries a core within the stranded copper wires. The space is filled with oil under constant pressure. Mr. Phillip Torchio, vice-president of the New York Edison Company, explains the theory of the oil-filled cable thus:

"Through its collapsible oil reservoirs it responds readily to volumetric changes in oil and cable due to temperature changes. In this manner, the whole cable is kept constantly filled with oil under pressure, both in the hollow core of the conductor and throughout the surrounding insulation. The unique advantage, therefore, of this type of construction is that, should the lead sheath be expanded or distorted, or the internal elements of the cable be displaced by temperature variation or other causes, the space thus formed will be immediately filled with oil, whereas in a solid insulation type, voids would be formed, causing ionization and ultimate failure."

The invention is said to double the operating voltage of an underground cable, permitting, for instance, the absorption in the New York Edison-United system of power generated on the St. Lawrence River or at Niagara Falls, and the direct supply of this energy to New York City at high voltage. In populous centers it has been necessary, in connecting high-voltage overhead lines to distributing stations and substations, to use transformers linking such high-voltage supply with underground cable lines of 33,000 to 66,000 volts. Intermediate substations may now be abandoned, it is claimed, the high-tension current being brought direct to the distributing centers. The ultimate economy promises to be considerable.

Progress is inevitable, and the best progress is in the direction of greater efficiency. The new underground cable development, in effect, is somewhat similar to that which has led to increased efficiency in submarine cabling in recent years. At first sight one might think that such improvements would restrict the consumption of base metals. The reverse is the case, however. Greater efficiency and lower cost invite wider application, and it is in the development of a vastly larger field of utilization of a product that prosperity is reached.

Smoke Farming Still to Be Considered

ONE hears less these days about the once remunerative occupation of smoke farming—the raising of agricultural products and livestock in the vicinity of smelters, where an occasional visitation of smelter fume and co-incidental damage to the farmers' property is hopefully awaited. Of somewhat the same nature is the occupation or avocation of fishing in waters supposedly polluted by slime or reagents, poisonous of course, from a milling plant; and of farming in a district where débris from gold dredging is a troublesome factor. In each instance, the degree of damage is likely to be magnified by interested parties who would grossly penalize a large industry for a minor nuisance.

Several years ago a great deal of attention was given to the effect of metallurgical smoke on vegetation, especially in the Salt Lake valley, where many experiments were conducted, followed by the issuance of a voluminous report upon the subject. Since then, most smelters have taken steps, either by controlling the smoke or controlling the farms, to eliminate the nuisance, but complaint may be expected to crop up again from time to time, especially when a new smelter is put in operation. Recently, for example, the Magma Copper Company was sued for $2,900 by a rancher near Superior, Ariz., who set that figure on his losses due to a poor crop, attributable, it was claimed, to the malignant condition of the atmosphere smelterwards. But, it seems, the conventional bugs and plant diseases were really to blame, as they usually are; the smelter fume may even be beneficial under such circumstances, but not to such an extent that an occasional Bordeaux spray is unnecessary. A new smelter is being blown in this month in northwestern Quebec; farming is not one of the leading industries in its immediate neighborhood, but the smelter officials would do well to consider the possibility of legal action for vitiating the atmosphere, possibly maintaining a few test gardens in nearby localities and keeping a record of wind directions, atmospheric conditions, killing frosts, and such matters. In fact, every mining or metallurgical plant that suspects that it may some time be accused of being a nuisance could well take some such precautionary steps for its own protection.

Mining With Open Stopes

PART II

By CHARLES A. MITKE
Consulting Mining Engineer, Phoenix, Ariz.

IN THE PREVIOUS PAPER (published in the Oct. 8 issue of *Engineering and Mining Journal*), methods applicable to small, scattered orebodies and to narrow veins, not requiring pillars or other forms of support in stopes, were discussed. In wider veins, large sheet deposits, and ore masses in hard ore with firm walls, it is impossible to extract all the ore from wall to wall without a general subsidence, and where this must be avoided some means of support must either be left or provided. In low-grade or medium ore it is found more economical to leave a part of the orebody intact in the form of supporting walls, or pillars of ore, rather than use waste fill. No attempt is made to reclaim these pillars, and they are left to support the back permanently.

Sometimes the pillars and stopes alternate in regular fashion, as in the Birmingham district. In other operations they are left only where needed, in an irregular manner, as in the sheet deposits of Joplin. In the Calumet country, pillars are usually left where the ore is of extremely low grade, and timbers and rock walls are used to reinforce or supplement the pillars. The character of these occurrences varies from the flat, thin, sheet deposits, like those of Grass Valley, Calif., to some of the thick deposits in Sudbury. The ore is broken at breast level and shoveled into cars; milled or benched down, as at Mascot, Tenn.; or carried up in the form of high shrinkage stopes.

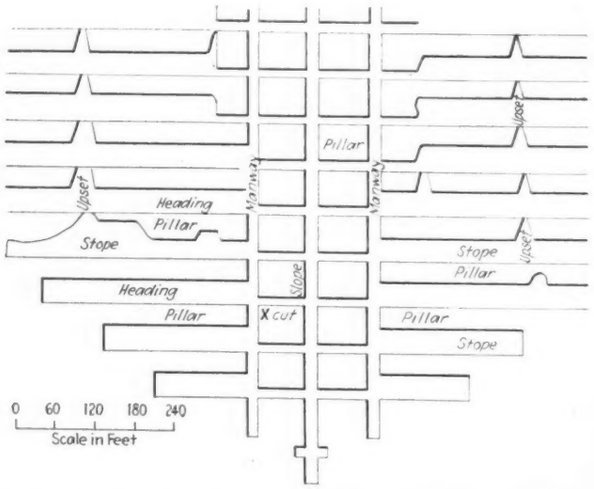

Fig. 1—Panel method of stoping in flat thin deposits

Where the stopes and pillars alternate, the amount of ore left in pillars to support the back varies from 10 to 50 per cent. Though at some mines a part of this is later reclaimed, in the majority of operations it is lost, and the pillars are left to support the back indefinitely. The open stope with pillars is also known as the room-and-pillar method, this latter title generally being applied to stopes in orebodies having little vertical thickness. The width of rooms and pillars is governed entirely by local conditions. In operations where the ore is soft and there is considerable capping, an unusually wide pillar must be left. On the other hand, if the ore is fairly hard and stands well, the volume left in pillars can be greatly reduced. The alternate room-and-pillar system is used in a great many mining operations, but frequently the location of pillars is irregular, and they are left only where necessary to support the back.

The types of deposits to which the open stope with pillars is adapted, and which it is proposed to discuss in this paper, are as follows:

Supported Methods Open Stopes (Hard rock methods.)	Open Stopes (Containing pillars or other forms of support, but no filling.)	Room and pillar. Flat thin deposits	Birmingham iron district, Alabama; Calumet copper district, Michigan; Gold mines, Grass Valley, California; Rand, South Africa.
		Open stope and pillar. Medium thick deposits.	Lead and zinc mines in Missouri, Oklahoma, and Wisconsin; Mascot, Tenn.
		Shrinkage stope and pillar. Thick deposits.	Granby; Kirkland Lake; Santa Eulalia, Mexico; some stopes in iron mines in Michigan; limestone mines in California and Pennsylvania; salt mines in Michigan, Alabama, and Kansas.

OPEN STOPES WITH PILLARS ADAPTED TO FLAT THIN OREBODIES

Under the above classification are the Birmingham iron deposits, Calumet copper, gold mines of Grass Valley, Calif., and the Rand, South Africa, and some of the thin iron deposits of Michigan. Many of these orebodies have great length and also considerable depth, the Birmingham district being productive for approximately twelve miles along the seam. Calumet copper lodes and some of the Rand gold mines also extend for many miles, whereas others may extend only one or two thousand feet along the outcrop. In deposits of this character, the stopes are usually carried up the entire thickness of the ore. As the orebodies extend for great distances, it is, of course, impossible to carry the stopes the entire length of the outcrop, and very soon the natural limits within which an excavation will support itself are reached. Very substantial pillars must, therefore, be left to support the back. Deposits such as those mentioned above range from 5 ft. to 20 ft. in thickness. As the ore is on the horizontal, or an inclination ranging from zero to 35 deg., it does not run by gravity, and scrapers must be used.

In the Birmingham district the ore is hematite and occurs in the Clinton formation, which is several hundred

feet thick and is composed mostly of shales and sandstones. The iron-ore bed known as the Big Seam is the most important. It is about 20 ft. thick and is divided in the center by a thin seam of slate from 1 ft. to 3 ft. thick. The two divisions of the Seam are known as the "upper" and "lower" benches. That designated the upper bench is the more important, and has an average stoping height of about 10 ft. The Seam dips approximately 30 deg. from surface to the 3,000 level (on the incline); from there to the 6,000 level it flattens out. It is faulted in places; in others it is horizontal; then, again, it rolls. These irregularities necessitate underground hoisting and considerable additional development work in barren rock. Though only 30 per cent of the ore was left in pillars from surface to the 3,000 level, in the deeper workings from 40 to 50 per cent must frequently be left, in order to support the heavier overburden. The large amount of ore which will probably have to be left in pillars in the future will necessarily increase development cost and hasten the time when some change in the mining method may become necessary.

The ore is stoped by two methods, known locally as *the panel,* which is really a hand, or drift, method, and *the scraper,* which is a machine method. Both are room-and-pillar methods, but, in general, the rooms and pillars in the panel system are at right angles to the slope (incline shaft), whereas those in the scraper system parallel the slope.

Panel Method—Slopes, or incline shafts, are driven on the dip of the orebody, and levels, called "headings," are driven approximately at 65-ft. intervals, and extend from the slope into the ore bed. The "headings" are then widened out and form the stopes, which are about 35 ft. wide, with pillars 30 ft. apart.

After the heading extends out about 200 ft. from the shaft, a raise is driven to the level above for ventilation, the passage of men, air lines, and complementary uses. These raises are locally called "up-sets." (See Fig. 1[1].)

The driving of the headings, work of extraction, or stoping—that is, drilling, blasting, and shoveling into cars—and tramming, is done by hand. This is the old hand method, which has been in use in this district for many years. About 45 per cent of ore from the district is produced in this manner. The remaining 55 per cent is mined by the machine, or scraper, method. A large percentage of the panel mining is carried on in the deeper workings, where the bottom shows a tendency to "heave" up, and care must be exercised to prevent the loose, insoluble material which forms the floor from mixing with the ore.

Room and Pillar With Scraper—Where scrapers are used, levels, 30 ft. wide, are first driven at right angles to the slope (incline shaft) every 200 ft. Double tracks are placed in these levels, which permits a train of cars to be loaded on the track near the stope, while the other track contains the truck with its motor and double-drum equipment for operating the scraper. Raises, or up-sets, are driven parallel to the shaft, about every 200 ft., and are widened out in the process of stoping. Both sides of the raise are drilled and blasted, and the broken ore is drawn down by scrapers into the cars on the level below. (See Fig. 2.)

Little shoveling is done by hand, it being necessary to shovel the ore only in corners or out-of-the-way places into the path of the scraper, whence it is taken from the stope. As yet little work is done on contract with this method. The tons per man obtained by the use of machines has greatly increased over that derived from panel mining, and there has been some decrease in cost.

The scrapers are heavy, weighing from 1½ to 2½ tons, and are operated with 50- to 75-hp. motors. Capacity of scraper load is about 2½ tons. In wide stopes, many props are used to prevent slabs of rock from falling.

Scrapers are also used in the Calumet copper district of Michigan, as well as in a number of iron deposits in Michigan and Minnesota, where the dip of the orebody is less than 40 deg. These ore occurrences bear many similarities to the Birmingham district. Large stulls are used, with occasional pillars, and the ore is broken small enough to be handled with scrapers.

In the Calumet district, native copper occurs in the amygdaloid and conglomerate lodes. The stoping thickness is about 18 ft., and the dip is approximately 25 to 45 deg. Where the ore is low grade it is left in place in the form of pillars. However, as this would not furnish sufficient support in many places in the mine, batteries of timber, consisting of three stulls each, are used wherever necessary to support the roof. Floor pillars are also left, and frequently rock walls are built along the levels. Though the general plan is to maintain the capping undisturbed, an unexpected subsidence occasionally happens, which accounts for the so-called "air blasts." When the stopes become very heavy, frequently the back is shot down along the line of stulls, so as to relieve the weight of adjacent stopes.

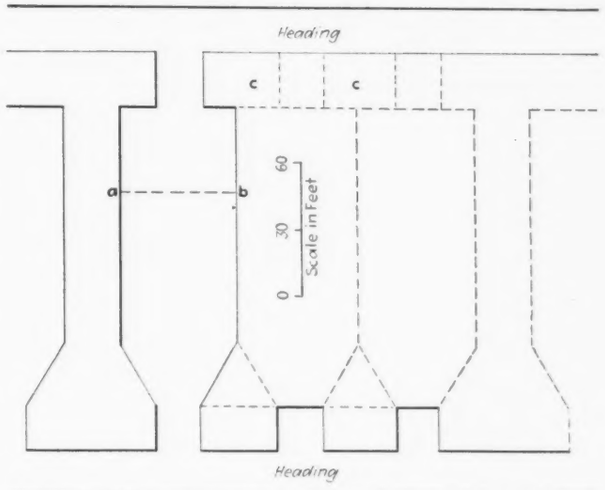

Fig. 2—Arrangement of stopes for scraper loading

In extracting the ore, raises are put up from level to level, and stopes started near the bottom of the raises and carried up the incline. Drifting machines and long steel are used in slabbing off the ore, and scrapers drag it down to the chutes. By locally standardizing the mining methods in the individual mines, where the ore will not run by gravity, scraper loading is becoming more important each year.

In Grass Valley, in some of the stopes, pillars are used as the principal means of support, though in others waste sorted out of the ore is thrown in large heaps, which later offers an additional means of support. The vein is very thin, which necessitates the breaking of considerable waste on either side to provide sufficient height for working purposes.

In certain gold mines on the Rand, in South Africa, pillars and "pigsties," built of rock and timber, are

[1]Fig. 1. *Trans.* A.I.M.E. Vol. 72, p. 161.

relied upon for support. In others reinforced concrete pillars are also used; and in still other mines sand filling must be added.

Deposits under the above classification are the lead-zinc

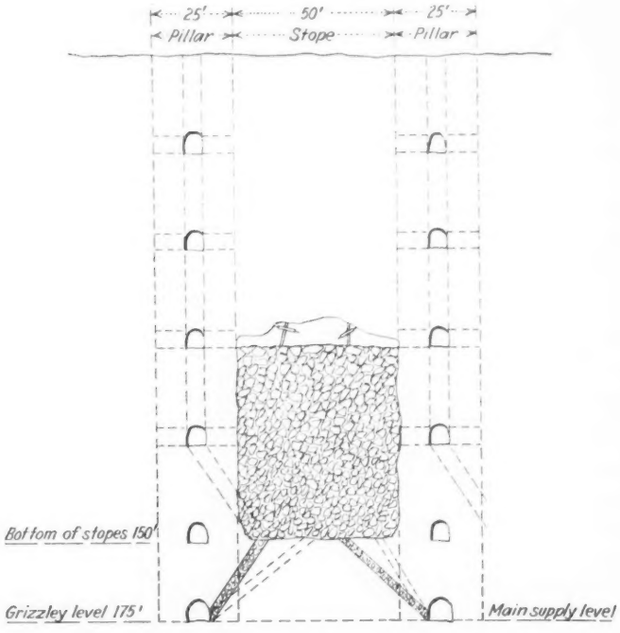

Fig. 3—Typical shrinkage stope and pillar

mines of Joplin, Mo.; Mascot, Tenn.; Picher, Okla., Wisconsin, and elsewhere. The ore is usually from 10 to 75 ft. thick, and though the orebodies do not have great length, they occur rather as a connected series of small deposits. In such formations the area to be supported is small, and, as the natural arching of the back assists, irregular or only occasional pillars are required.

In the Joplin district, the ore deposits may be divided into two classes—(a) sheet-ground deposits: flat-lying orebodies in tough, bedded, cherty flint; and (b) irregular deposits: orebodies of a great variety of shapes and forms, in which the chert or limestone is mineralized. The ore is 5 ft. to 30 ft. thick. In shallow deposits of this kind, where the back is good, and the ore low grade, so that it is cheaper to leave pillars than resort to timbering, mechanical shovels as well as scrapers have a general application. In this district the orebodies have not sufficient vertical extent for shrinkage stoping. If, as sometimes happens in exceptional instances, the ore and surrounding waste rock are very firm in these small irregular deposits, then the ore is quarried out in benches, or by the underground mill-hole system, as used at Mascot, Tenn. However, few deposits anywhere lend themselves to this class of mining.

In starting a mill-hole stope, a raise is put up in the center and bench work, or mill holing, is begun near the top. The miners start with jackhammers and drill a series of down holes around the raise. After these are blasted, a second series, or bench, is then started. The operation is then continued until the mill hole takes the shape of a funnel. If the orebody is fairly large, a pillar is left either near the center or on the side of the stope to keep the ground from moving.

The open-stope-with-pillar arrangement of stoping differs from the operation described in the preceding paragraph, in that shrinkage stopes and pillars are planned at regular intervals. A large number of thick, low-grade deposits, in which the ore and surrounding rock is hard, lend themselves to this method. Pillars in the orebody, as well as floor pillars, are left to keep the ground from caving. The stopes are usually from 25 ft. to 75 ft. wide, and the pillars are generally left in the form of walls from 5 ft. to 50 ft. thick.

Many examples of this type of shrinkage stope are to be observed in the mines of the Sudbury and Porcupine districts; in the copper mines in British Columbia; in some iron mines in Michigan and Minnesota, and in the lead mines of Santa Eulalia and Mapimi, Mexico. This method is not confined solely to metal mines. It has been the practice in many anthracite beds in Pennsylvania, and is being adopted on a large scale in limestone mines throughout the country, and also in underground salt mines. (See Fig. 3.)

The room-and-pillar method is sometimes used where there are expensive surface improvements above the mine workings, or lakes or rivers, which would flood the mines if the capping were broken, the stopes being carried up in much the manner illustrated in Fig. 1 of the first part of this article. The amount of ore left in pillars depends on the firmness of the ground. Where the ore is of sufficient value, so that a profit might be made by reclaiming this pillar ore, some method of obtaining a higher recovery should be worked out.

Summary

In the room-and-pillar method, apart from the question of recovery of ore, there is also the question of roof support. This factor is one of the first to come up in the selection of a stoping method. It also forms a part of the daily work at every mine as local decisions must be made regarding roof support in individual places.

The necessity of supporting the back adequately is not a modern idea—it was recognized centuries ago. Agricola, in describing the duties of a foreman, mentions that he should know how "to make underground structures capable of supporting an undermined mountain, lest the rocks from the hanging wall of the veins, not being supported, become detached from the mass of the mountain and overwhelm the workmen with destruction." The temptation, however, is constantly to make stopes wider and to shave pillars down, with the object of recovering more ore, until they become so small that they will not support the back, and begin to cave and break. As a result large caves have taken place, and sometimes a subsidence, acres in extent, has accompanied these conditions.

"The maintenance of the roof of mine workings is the main object of support. The unit values of the top rocks acting as beams, and the compressive strength of ore acting as supports, are essential to a thorough and complete understanding of the problem of roof support."[2]

When the strength of the ore and weight of capping are known, safe working loads for pillars, with ample factors of safety to insure permanent support, can be determined.

The most important features of all room-and-pillar methods of stoping are "the width of stope" and "type and size of pillar support" that must be used. These vary with the character of the ore and the character and thickness of the overburden.

When the stopes are being planned, a decision must be made as to whether the pillars are required merely to support the back until the ore has been removed, or the

[2] "Roof Support in Birmingham District." By W. R. Crane. *Trans.* A.I.M.E., Vol. 72.

back of the abandoned stopes, after extraction is completed, must be permanently supported. This latter condition requires the leaving of much larger pillars than the former. Important considerations which influence the planning of this method for a particular orebody are as follows:

Character and thickness of ore and capping.

Compressive strength of the ore.

Physical character of ore to be left in pillars.

Fault planes in the ore and capping.

Presence of water and the effect of "air slaking" on roof and pillars.

Angle which pillars are to assume.

Pressure of Overburden Most Common Cause of Failure of Pillars

Though many causes contribute to the failure of pillars, such as the effect of air and moisture, generally known as "air slake," pressure from various angles, careless shooting, careless placing of holes, and excessive use of powder, by far the most important would appear to be pressure of the overburden or capping.

The wide open stope with pillars is used in a large number of deposits where the back is firm and a wide stope can be carried up with safety, as, for example, at the Levack mine, at Sudbury, Ontario, Canada. When the ore occurs in blanket formations and breaks off in horizontal slabs of, say, 10 to 20 ft., the wide shrinkage stope is not applicable. To meet such a condition, the problem is frequently solved by a series of very narrow shrinkage stopes, 8 ft. to 15 ft. wide.

Methods that are perfectly safe in one class of ground frequently prove dangerous in another. For instance, in hard ground in which the shrinkage method is applicable, places may be found where a stope 30 ft. to 60 ft. wide can be carried up with perfect safety, whereas, in certain other mines, ground with equal hardness will show a tendency to slab off in blocks approximately 10 ft. x 20 ft. and several inches thick, owing to the stratified formation of the back. In such ground, a 30-ft. stope would be most dangerous, and the stoping width would undoubtedly have to be narrowed down to 15 ft. or even to 10 ft. Stoping machines that operate either vertically or at an angle, and which may be used with perfect safety in the first type of hard ground, might in the second type mentioned have to be replaced with drifting machines, and drilling carried on horizontally, so as not to disturb the roof, in order that the miner may always stand under an unshaken back. Frequently, narrow shrinkage stopes can be carried up successfully in "slabby" ground by using drifters and a stull and head board, where it might prove impossible when stopers are employed.

In medium or high-grade ore, where the walls are not very firm, square-set timbering is carried up occasionally, without the use of floors, in order to steady the ground until such time as the entire stope is filled with broken ore and all of it may be drawn as in the manner of a shrinkage stope. In such operations the timbering stands until it naturally decays, and large slabs begin to fall from the sides and break the timbering. This, of course, usually happens long after the stope has been worked out and abandoned.

Where the surface over the orebody is such as will permit of subsidence, and the orebody itself pitches steeply, a question arises as to whether to use the room-and-pillar method or some form of caving, in which a high recovery can be obtained.

National Chamber Addresses the President on Subjects Before Next Congress

IN A RECENT letter to the President, the Chamber of Commerce of the United States expresses its views on a few of the subjects coming before the Congress soon to assemble. "In advocating these policies," states the letter, "the National Chamber aims at economy and efficiency in government, together with the elimination of any tendency toward governmental paternalism or bureaucracy:

"1. Co-ordination of government administrative activities, doing away with overlapping on the part of bureaus, commissions, and departments, is a basic necessity in any program for a more efficient and economical administration. We believe that efforts to secure such co-ordination should be continued to a successful conclusion.

"2. There is an increasing danger in the growing pressure on government to enter into those fields of activity which it is more proper to carry on by private enterprise. This not only increases the cost of government, but is definitely antagonistic to the principles on which this government was founded and on which it has been builded to its present position of leadership. In the past, certain groups or localities have urged government to enter these realms, without realizing that dangerous precedents were being established. The National Chamber believes it is time to call each proposed encroachment to the attention of the American people in the belief that the evil, once recognized, will be condemned."

Extraction of Zinc by Ammonia Leaching

AMMONIA LEACHING, as a process for the extraction of zinc from complex ores or other zinc-bearing materials, has certain possibilities that are summarized briefly by H. M. Lawrence in a recent bulletin of the Missouri School of Mines as follows:

1. If calcines from the roasting of sulphide ores are treated, zinc extractions are likely, in general, to be somewhat lower with an ammonia than with a sulphuric acid leach. However, fewer impurities would be dissolved by the ammonium carbonate solutions, and their subsequent removal should be more readily effected.

2. If sulphide ores are fumed and an amenable fume product is secured, treatment with ammonium carbonate solutions should yield high zinc extractions in a liquor that can be readily purified.

3. Satisfactory recoveries of desired metals from (1) or (2) should be made by smelting or other methods.

4. If distillation of the purified pregnant liquors is practiced, the precipitation of the zinc as basic carbonate or hydrate and the reclamation of the reagents should be effected with an economical steam consumption and with but little loss of ammonia. Oxide produced by calcining the precipitated zinc carbonate and hydrate would probably require refining to obtain a marketable grade of zinc oxide.

5. The possibility of obtaining zinc as metal by electrodeposition from purified zinc ammonium carbonate solutions warrants investigation.

6. For successful operation a well-designed plant, accessible for observation and repairs, is essential. Corrosion of equipment should be less than with ammonia processes for copper ores.

Swing-Hammer Crushers—Their Design and Application

By W. T. W. Miller

Engineer in Charge, Crushing Machinery Department, Hadfields Limited, Sheffield, England

IMPACT PULVERIZERS are a numerous family including a great variety of machines, some with cages, some with paddles, some with fixed beaters, and others with loose or pivoted hammers as the striking media. For dealing with resistant material, the flexibility of the swinging hammers is a feature of great advantages, and machines of this type have gradually been adapted for work entirely outside their original sphere of usefulness. The larger units can fairly claim to be classified among the crushers or granulators as distinct from the pulverizers. Although their field of service is usually limited to the breaking down of the less abrasive materials, such as limestone, shale, phosphates, gypsum, barytes, or asbestos rock, they have been found to work quite well on some of the harder stones and ores.

During the last few years swing-hammer crushers of large size have displaced gyratory and secondary breakers in several plants for reducing cement rock to a size suitable for feeding to ball and tube mills. They have proved capable of undertaking the work in a single stage, crushing blocks up to a 3-ft. cube to a finished product of 1 in. and under. The makers claim that in some instances a ratio of reduction of fifty or sixty to one may be obtained.

The Real Inventor Obscure

When tracing the history of the swing-hammer crusher it is difficult to arrive at a definite conclusion as to the real inventor, but the name of Milton F. Williams is inseparably associated with the development of the machine, and one of his early patents is illustrated in Fig. 1. This design appeared in 1895, but it has many features in common with the machines now in use. The multiple hammers, made from narrow rectangular bars, were pivoted on pins passing through holes in a series of disks mounted on the main shaft, which was carried in bearings supported by a timber framework.

The housing or casing was divided horizontally, the upper part consisting of a semicircular removable cover and the lower portion being shaped to form an open box without a bottom but with a feed hopper integral with one of the sides. A series of bars passing through slots in the lower walls of the chamber were arranged as a grating to span the opening in the base, the spaces coinciding with the path of the hammers and the bars being in line with the separating disks in the rotor.

The shaft was driven by a belt at a sufficiently high rate of speed to insure that the hammers were held in the radial position by the action of centrifugal force. (In his specification Williams suggested a speed of 300 r.p.m.) The material to be crushed entered the chamber through the feed spout, lodged on or across the grate bars, was struck and shattered by the descending flail-like hammers until it was fine enough to pass the openings and escape to the outlet. This system of breaking on the grid bars is still used by some machine builders, but in most cases a separate breaker plate is provided to receive the heavier blows required for primary crushing.

Inasmuch as the screen slots had to be of considerable length to leave clear tracks for the hammers, the bars could not be strengthened by cross bearers and were likely to get bent by material wedging in the apertures. It was not possible to build a machine on this principle with fine grate openings, as the spaces had to be wide enough to permit free passage of the hammers under all working conditions.

A Further Step

Fig. 2 will serve to illustrate the next stage in the development of this type of crusher. The transverse grate bars were arranged in a semicircle just clear of the tips of the hammers and the feed chute was extended in a line tangential to the inside of the cage with a breaker plate incorporated in the lower part of the feed box. The hammers revolved toward the feed, and the larger lumps, sliding down the chute, were broken on the dead plate before traversing the ridged surface created by the indentations between the screen bars. The machine shown is typical of the more primitive units in use at present. Its maker, the Jeffrey Manufacturing Co., classes this as its Type "A." The reversible hammers indicated are a special feature of the equipment made by this company.

Before proceeding further it is advisable to explain that the sectional views, Figs. 1 to 12, have been arranged on the sheet in such a manner that the direction of rotation of the hammers is uniform in all cases and anticlockwise. This arrangement was made to emphasize one feature which could not otherwise be made clear, and that is the relationship of the feed opening to the track of the hammers.

Several methods of feeding are adopted. Sometimes the material is made to slide under the hammers as in Figs. 1, 2, 4, and 9; at other times it falls on the ascending hammers, as in Figs. 3, 7, 10, and 11. In some instances the blows are struck on a stream falling vertically with the descending hammers, as in Figs. 6 and 12. In Figs. 5 and 8, the stone falls on top of the rotating drum.

Figs. 1 to 12—Types of impact pulverizers. The sections are so arranged as to demonstrate the relationship of the feed opening to the track of the hammers. In every case the hammers rotate in an anticlockwise direction

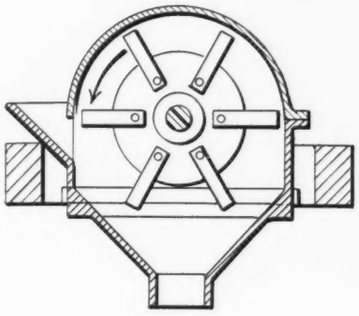

FIG. 1

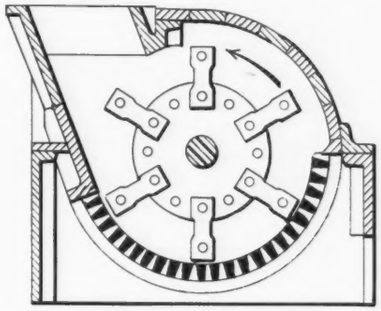

FIG. 2

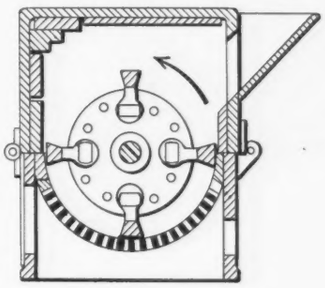

FIG. 3

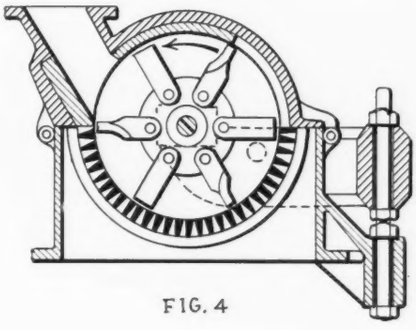

FIG. 4

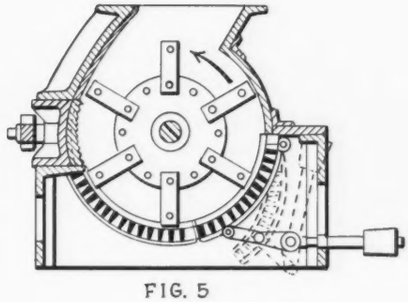

FIG. 5

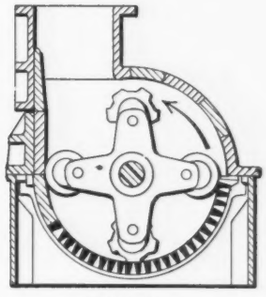

FIG. 6

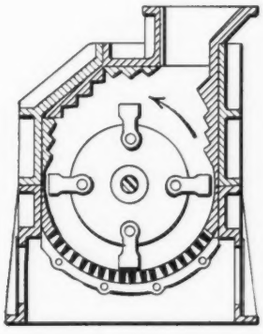

FIG. 7

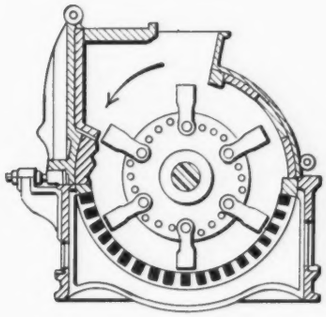

FIG. 8

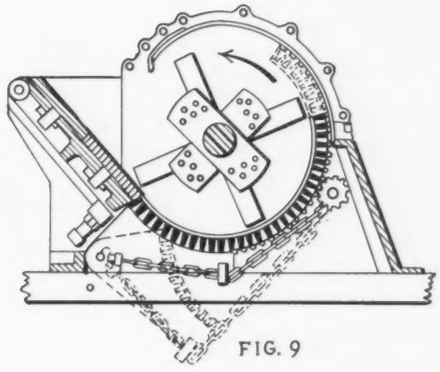

FIG. 9

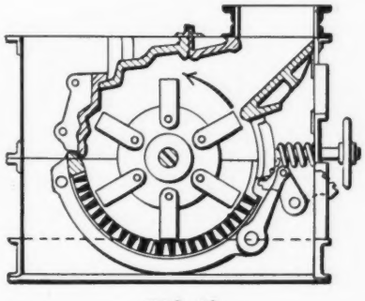

FIG. 10

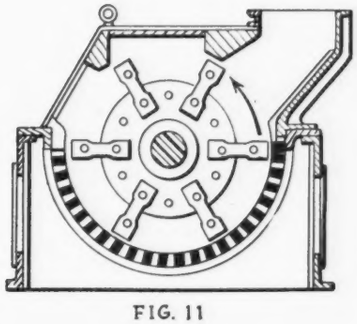

FIG. 11

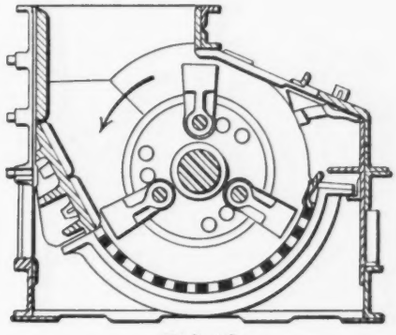

FIG. 12

It should be noted, also, that there are two, or possibly three, principles of operation for the work of preliminary reduction. The material is supported on a dead plate to receive the initial hammering, as in Figs. 1, 2, 4, and 9, or it may be driven by the hammers against the roof and end of the chamber as in Figs. 3, 7, 8, 10, and 11, or pounded against the end walls as shown in Figs. 5, 6, and 12.

There is a definite relationship between the method of feeding, the internal shape of the chamber, and the system adopted for absorbing the energy of the hammers,

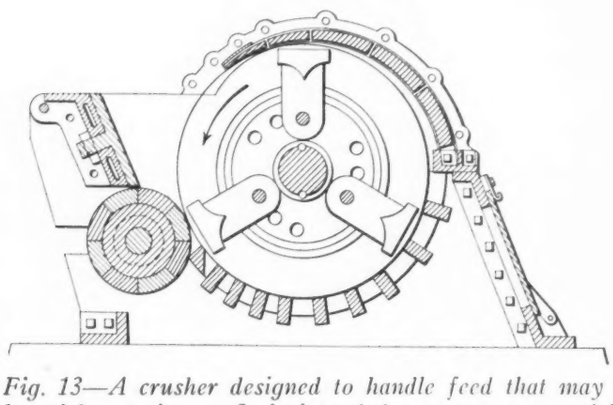

Fig. 13—A crusher designed to handle feed that may be sticky at times. It is intended to prevent material clogging at the inlet or packing between the screen bars

which will be made a little clearer as this article progresses.

Fig. 3 illustrates a type of swing-hammer crusher introduced in France and England about 1904. Instead of rows of multiple bars with narrow striking faces, this machine was fitted with U-shaped or "stirrup" hammers, the length of the head being approximately equal to the width inside the chamber. The rectangular shape of the upper half of the casing allowed ample clearance space above the path of the rotor, and the material was lifted by the hammers and dashed against the roof plate, from which it rebounded to be driven again and yet again to the breaker plates until it passed into the lower part of the chamber. This machine is popular in England at present. Fitted with heavy manganese-steel hammers, it is being used in gravel plants for reducing flint shingle to a $\frac{3}{4}$-in. product. As these pebbles are almost pure silica, the duty would be considered impracticable by many hammer-crusher builders. Under these conditions loss by wear is considerable, but users find that there is little advantage in fitting four hammers as shown, and, if the operating speed is correctly adjusted to suit the product required, two hammers diametrically opposite give satisfactory results. By adjusting the speed it is also possible to work the machine without grid bars, which gives greater output with reduced maintenance charges. In fact, it is only by lessening the number of the hammers and eliminating the grate bars that the reduction of high-silica compounds is brought within the bounds of economical working.

Secondary Reduction Usual

Although the cage bars are omitted in rare instances, it is usual to effect a secondary reduction on the material after the preliminary crushing on the breaker plate or in the upper part of the chamber. This second crushing process may be carried out in the lower half of the interior, or the oversize material may be driven round and rebroken by impact against the roof plates so that both large and small particles are subjected to the same shattering action.

It is obvious that for the secondary reduction process the cage bars must be retained. In many cases the shearing action of the hammers against the edge of the breaker plate and against the riffles formed by the grate bars is utilized to accomplish this duty. When the bars are close-pitched for a fine product the principal function of the cage is to screen the material and retain the oversize for further reduction.

In the machine shown in Fig. 6 a rolling motion takes the place of the shearing action and the material is ground and forced through the screen apertures. When the efficiency of the machine depends on the shearing force it is necessary to provide means of adjustment to compensate for wear on the hammer tips and inner surfaces of the grid bars. This may be done by bringing the rotor closer to the cage, by setting the pivot pins at a larger radius, or by swinging the cage toward the hammers.

Fig. 4 is an example of the first method of adjustment. The bearings for the drum shaft are carried in a heavy yoke which is hinged on pins in the lower half of the frame. This yoke encircles the housing on three sides and has a central boss in line with a similar projection on the base plate through which passes a long adjusting screw. By raising or depressing the outer end of the forked lever the rotor is set and locked in the desired vertical position.

Tramp Iron Dangerous

Swing-hammer crushers are high-speed machines and are particularly susceptible to damage when any loose uncrushable material enters the chamber. They must also be fed regularly; otherwise the free spaces necessary for the proper functioning of the hammers become choked and the material churns around in a mass. It is therefore an advantage to be able to open the cage to release any foreign matter or to relieve a pack caused by clogging of the screen spaces or by overfeeding. Fig. 5 shows a machine constructed with a drop bottom or hinged door which may be swung clear for this purpose. A number of the screen bars are set in a frame pivoted near its top edge and secured in the working position by a system of toggles balanced by a weighted lever outside the housing. By throwing over the lever the screen door swings back to empty the chamber.

Fig. 5 also indicates an adjustable breaker plate immediately above the grid bars on the entry side. By a careful and methodical use of this device the regularity of the product can be maintained, notwithstanding loss by wear on the hammers.

Fig. 6 is a cross-section of the American ring crusher, made by the American Pulverizer Co. Strictly speaking, this is not a swing-hammer machine, but the hammers are flexibly mounted on a distinctly novel principle. The striking faces consist of a series of rings, some being perfectly plain and others indented on their peripheries. All the rings are pierced with holes of a diameter considerably greater than that of the pins on which they are threaded, allowing perfect freedom for radial displacement and constant change in the contact faces. The makers claim that not only is the action peculiarly effective in the reduction of materials of irregular hardness, but the ability to override uncrushable substances is a real safeguard against damage by foreign matter.

An English machine, the Mansfield granulator, work-

ing on the impact principle with a series of short heavy hammers carried close together in rows between disks set a considerable distance apart, is shown in Fig. 7. The close spacing of the hammers gives a practically unbroken crushing line between the disks, and there is rarely more than one intermediate disk, so that the sweeping action is almost continuous and particularly effective for fine crushing.

The Jeffrey company makes a special crusher for limestone, as shown in diagram form in Fig. 8. Material to be crushed is fed directly over the rotor and is not lifted by the hammers, but is driven horizontally against the breaker plates, which are fixed on a heavy door hinged at the top of the frame. The lower liner on the door consists of a corrugated shearing plate, which can be adjusted close to the tips of the hammers on swinging the door forward by means of strong pinching screws. Holes in the disks for the hammer rods are arranged in spiral form to allow of the hammers being set to larger radii as they become shortened by wear.

The Williams Patent Crusher Co., which has designed and built some of the largest and most powerful crushers of this type, has favored for many years the construction shown in Fig. 9. This is a typical example of the underfed design. The material enters on a sloping breaker plate, which is hinged at its upper edge, secured by flanges and bolts to the side plates, and adjusted by set bolts underneath its lower end. The driver consists of a series of plates or disks keyed to the shaft with a range of holes at varying centers for the hammer rods. Each circle of hammers is supported by a disk on either side, so that plates and hammers alternate in building up the rotor. One part of the cage is hinged and is supported in its working position by underslung chains attached to chain wheels on the spindle spanning the lower part of the frame. The other sector of the cage rests in recesses in the side plates and has gear teeth formed on the back of the cradle meshing with a toothed pinion on the manipulator shaft. The relative positions of the rack, pinion, and chain wheels are adjusted so that a single turning movement on the spindle causes the hinged part of the cage to fall clear while the remaining portion is raised through an arc of the circle by the influence of the gearing. This simultaneous movement creates an aperture nearly equal to the full diameter of the chamber. The pivot pins for the hinged section work in slots in the side frames, so that this part of the cage can be adjusted closer to the hammers.

In many instances the frames of these swing-hammer crushers are made in cast iron, but the demand for machines to undertake heavier duty on harder materials has led to the introduction of fabricated frames made from structural steel. A machine of this pattern, of the "Ajax" series made by the Pennsylvania Crusher Co., is illustrated in Fig. 10. This particular crusher is of the top-fed type, the chute plate entering the chamber in a similar position to that shown in Fig. 3. The breaker plates are shaped to present a series of square faces to the impinging material, so that, as far as possible, all glancing blows are avoided and no useful work is lost. The cage is contained in a separate framework of cast steel, which is hinged close to the last of the dead plates, its free end being supported by a system of levers and connecting rods operated by a worm and handwheel, so that the cage can be adjusted, while the machine is running, to bring the screen surface nearer to the hammers.

Fig. 11 shows a machine of a similar type, but with cast-iron frames, made by the Jeffrey Manufacturing Co. The breaker plates project some distance into the roof cavity and are arranged at wide intervals, presenting a series of anvil faces to the flying pieces. The feed chute enters the chamber close to the horizontal center line, and the initial blows have to lift the material, which entails a greater expenditure of power, but this position of entry allows the greatest space for the work of primary reduction, as the material is tossed violently back and forth from hammers to breaker plates for a complete semicircle of movement before it reaches the screening zone. In any machine of this character the peripheral speed of the rotor should be regulated to suit the friability of the material and the extent of reduction to be made. A velocity of about 200 ft. per second at the tips of the hammers is a fair average speed.

Figs. 2, 5, 8, and 11 are all taken from Jeffrey lists and serve to show that the same maker builds machines of varying types for different purposes. Fig. 12 is a further example illustrating this statement. This figure shows, in diagrammatic form, a second steel-frame hammer mill built by the Pennsylvania Crusher Co. It will be noted, on comparing Figs. 10 and 12, that the feed hopper is situated on opposite sides of the housing and that the former machine has a long impact zone and the latter a relatively short dead plate, depending on direct hammering against the breaker plate rather than on impact. This machine is fitted with heavy hammers, and the rows are reduced to three in number, allowing greater clearance for the material to travel between each series of blows. It would seem that, when the hammers are close-pitched around the circumference, the blows are increased in number, but the efficiency is less than when they are arranged as shown. This tendency to reduce the number of the hammers and increase their weight is becoming more noticeable in recent machines.

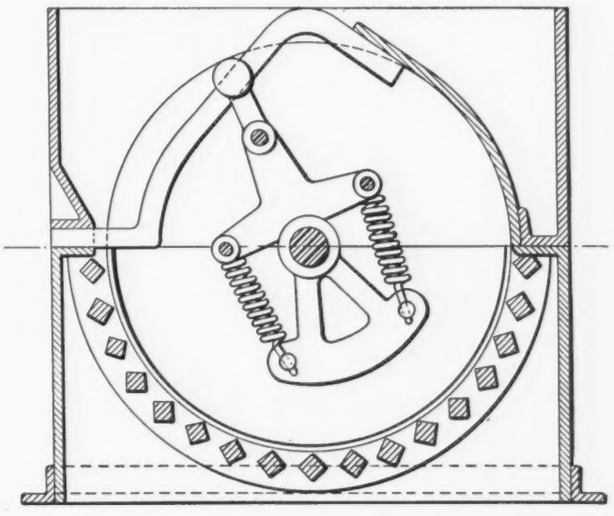

Fig. 14—A swing-hammer crusher designed for crushing rock salt

When dealing with rock mixed with clay or a shale which becomes sticky in wet weather difficulty has been experienced with the material clogging at the inlet or packing between the screen bars, and some makers stipulate that their machines should not be used when the moisture content exceeds 5 per cent. The Williams "Non-clog" crusher, shown in Fig. 13, has been designed to overcome this trouble. A revolving roller, driven by a chain from the rotor shaft, replaces the lower part of the dead plate and keeps the material constantly agi-

tated at the feed point. Any accumulations of clay and fine material which might build on the roller are removed by a fixed scraper. In another design for dealing with mud and clay the breaker-plate consists of a heavy plate belt which is kept constantly moving toward the interior of the mill by a separate motor drive.

This brief explanation of the various types of swing-hammer crushers would be incomplete without some reference to a series of machines which are used on the Continent of Europe and have made their appearance also in the United States. In these crushers the material is fed into a pocket or well with screening slots in the sides and base through which the hammers pass. The coarser pieces are retained by the grate bars until they are broken to a suitable size for satisfactory reduction in the screen chamber. Fig. 14 shows a machine of this pattern introduced in Russia, about 1910, by J. W. Scherrer for the treatment of rock salt. The hammers are knuckle-jointed to an intermediate member which is flexibly connected to the driving shaft; the swinging head is attached to an inverted tee-shaped bracket, which is bored to fit loosely on the shaft; and the wings of the tee are spring-coupled to the arms for a cast-steel sector, which is keyed to the shaft. This system of mounting doubly cushions the blows and greatly reduces the shocks from the harder rocks.

The material to be crushed falls into a funnel-shaped chamber in which the base and one side are composed of gratings. Any pieces which are small enough pass freely into the lower chamber; the larger lumps, resting on the the grid bars, are broken by the hammers which work

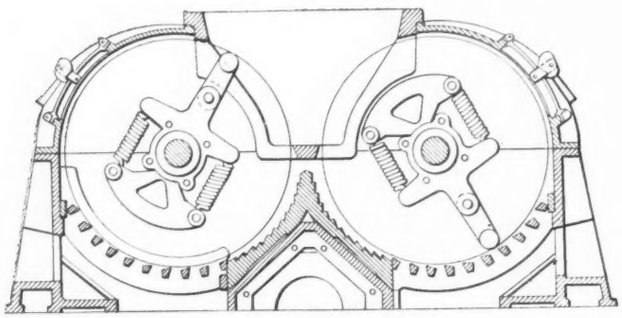

Fig. 15—A swing-hammer crusher of German design. It has two shafts and two finishing chambers, with a central grille for retaining the coarser material

between the bars, and the disintegrated material reaches the interior for the final reduction process.

The "Titan" breaker, Fig. 15, made by Amme Giesecke and Konegan, of Brunswick, Germany, operates on a principle similar to that of the machine just described, except that it includes two shafts and two finishing chambers with a central grille for retaining the coarser material. The action of this machine is much livelier than in the single unit; the lumps lying on the grate bars are driven by one series of hammers into the path of the descending hammers on the second shaft, and there is little opportunity for the formation of a dead zone in the feed receptacle.

In many operations hammer mills are driven by direct-connected motors, although it is usual to interpose flexible couplings to take care of irregular wear on the bearings. The load is subject to rapid fluctuations, especially when the machine is not being fed evenly, and most mills are provided with heavy flywheels to flatten the peak loads. The mass of the hammers, rods, and disks is also a considerable item and adds to the flywheel energy, but a high torque must be applied to bring the rotor up to speed in a reasonable time. The mill should always be run clear of material before it is stopped, and, in the event of an accidental shutdown, the chamber must be emptied before restarting.

Why Mining Men Should Buy Autos

THE importance of the automobile industry as a consumer of metals is not generally realized. About a quarter of all the aluminum, tin, and nickel produced in or imported into the United States finds its way into motor cars, as well as about an eighth of the iron and steel, copper, and lead. The following table, compiled by the National Automobile Chamber of Commerce, shows consumption figures in the United States for 1926:

Material	Amount, Pounds	Percentage of Total U. S. Production
Iron and steel	9,700,000,000	14
Aluminum	50,000,000	25
Copper	250,000,000	12.7
Tin	33,400,000	21
Lead	220,000,000	13.7
Zinc	55,000,000	4.3
Nickel	9,250,000	28
Rubber	607,232,000	84.7
	Square Feet	
Plate glass	64,500,000	50
Upholstery leather	39,050,000	63
	Board Feet	
Lumber, hardwood	830,390,000	11
Lumber, softwood	250,000,000	....
	Yards	
Cloth, upholstery	39,500,000	....
Top and side-curtain material	13,755,000	....
	Gallons	
Paint and varnish	15,500,000	....
Gasoline	8,566,450,000	80
Lubricating oil	350,000,000	26

Rubber, tin, and nickel, of course, are not produced in the United States, the percentage named being based on imports. In 1921, according to figures compiled by the American Bureau of Metal Statistics, the automobile industry consumed only 95,000,000 lb. of copper.

Copper is used in the electrical system of automobiles, says H. W. Gillett, in *Industrial and Engineering Chemistry*, because of its electrical conductivity; in the radiator because of its resistance to corrosion; and in the gas and oil lines largely because of the latter property, since rust would clog them. The ability of copper to be drawn, rolled, or stamped fits it for all these uses, as well as for gaskets. No other material is so suitable for many of these purposes, especially for piping, as copper has a unique combination of ability to stand severe cold-working in forming, of suitable mechanical properties (sufficient strength and the ability to be bent without damage), and of resistance to corrosion.

Copper Penny New to Alaska

Although copper has been mined in Alaska for about a quarter of a century, virtually the first copper pennies to be introduced into the territory will be placed in circulation in the near future, according to an Associated Press dispatch from Cordova, says the "Copper and Brass Bulletin." A new store in that community has ordered a large shipment for its opening. Heretofore the nickel has been the smallest coin in general use throughout Alaska.

The Buckingham District
Province of Quebec

By R. C. ROWE
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R. C. ROWE

WHAT is generally known as the Buckingham district is one of the oldest, and, in some ways, one of the most interesting, mining districts in Canada. It has never been spectacular in the way that other and greater fields have been, and a great deal more money has been sunk in it than has ever been taken out; but a number of minerals have been mined at various times, among which may be listed apatite, graphite, phlogopite and muscovite mica, feldspar, and quartz. Others such as molybdenite, galena, and asbestos are known to occur, but have not been worked extensively.

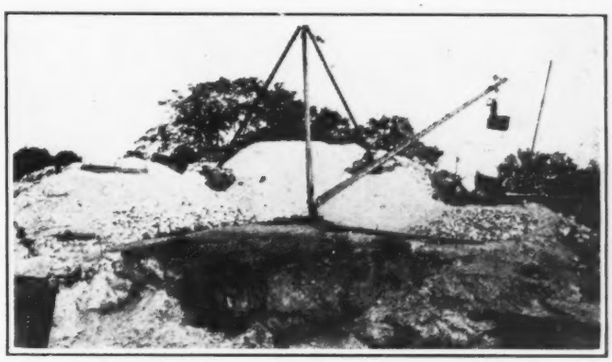
The town of Buckingham, after which the district is named, is situated on the Lievre River about 20 miles east of Ottawa. All the minerals mentioned occur in the valley of the river within a 20-mile radius of the town.

The geology of this district is particularly complex, and has never been satisfactorily unraveled; lack of conformity renders discussion of it distinctly difficult. By far the greater proportion of the rocks of the district are gneisses of various types, though large areas that are unmistakably of a normal granitic character are encountered. The gneisses are a complicated mixture of igneous rocks and highly altered sedimentaries. Through this mixture are bands, or zones, of a distinctly calcareous nature. These will often take the form of highly impure crystalline limestones, which are readily distinguishable. In other instances, the limestones have been so greatly altered that they are almost indistinguishable, except for their perceptibly calcareous nature, from the igneous rocks that have acquired a gneissose structure. Therefore, we find a complete system of granite-gneisses, calcareous gneisses, and crystalline limestones which is entirely lacking in uniformity, and which is twisted and distorted in a most puzzling manner. Cutting through this, there is, further, a system of pegmatites. These are scattered through the region in great profusion, sometimes in the form of well-defined dikes, ranging from a few inches to hundreds of feet in width, and sometimes in apparently disconnected "splashes," which often cover large areas.

In addition to the pegmatites, there are a large number of pyroxenite dikes. These have been termed dikes, though there is, apparently, good deal to doubt whether this is their true character; it is probable that they are an altered form of the crystalline limestones of the district. Their development is not common to the whole region, being confined largely to the apatite belt; however, scattered occurrences can be noted throughout the district. They are evidently of earlier origin than the pegmatites, as there are instances where they have been cut by the latter. Numerous diabase dikes cut the whole system in various directions.

The economic minerals of the district are found only in the calcareous gneisses and the crystalline limestone, in conjunction with the pegmatites and pyroxenites, and in phases of the pegmatites themselves.

The apatite deposits of the Lievre River were first noted and recorded by a Lieutenant Ingall in 1829. There was no exploitation of any of the occurrences for many years, however, until the demand in Europe for raw phosphate for fertilizing purposes caused the intensive exploitation of the deposits in the late seventies. From then until 1889 and 1890 the industry expanded rapidly—more than 27,000 tons being shipped in each of the years mentioned. After 1891 production began to fall off, until it practically ceased by 1896. The cause of the decline was the operation of the sedimentary deposits of phosphate of Florida and Tennessee.



Feldspar quarry in the Buckingham district

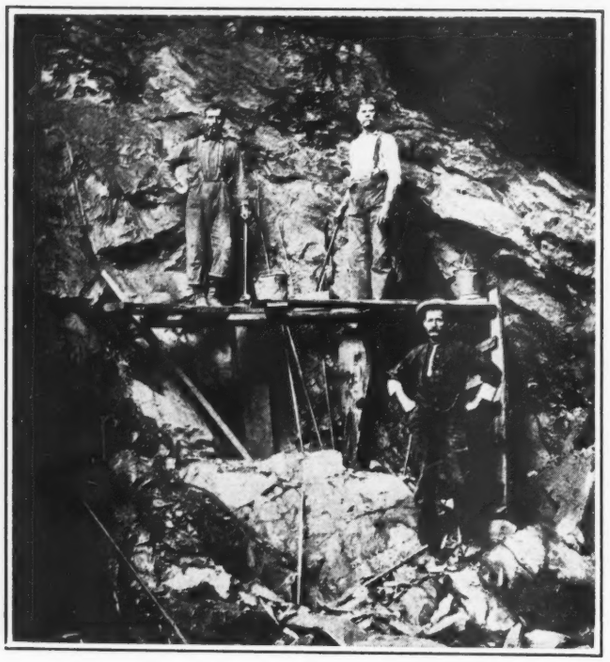
The Buckingham apatite is a particularly high-grade phosphate of lime, and many shipments running over 87 per cent tricalcic phosphate were made. It invariably carries fluorine—usually about 3 per cent.

The apatite occurs in irregular masses in pyroxenite, in three forms. Most usual is massive crystalline apatite. Less common is "sugar phosphate," which consists of an aggregation of small, rounded grains that can be disin-

tegrated with the fingers into sand. The third form is in individual crystals, with calcite and mica. This latter is characteristic of mica deposits, and was never a commercial source of apatite.

The deposits themselves are irregular in form and erratic in occurrence. They lack continuity, sometimes pinching out, in a few feet, to a mere stringer that may persist for some distance before it widens out into another pocket or body of the mineral. It will be obvious that, under these conditions, the winning of apatite, even in the palmiest days of the industry, was attended by a good many elements of uncertainty, and a large amount of dead work was a feature of the operations. In view of this factor, it is improbable that any development of this field will take place so long as phosphate from the various sedimentary deposits is available, unless it be that some special branch of industry materializes for which apatite is specially and peculiarly suitable. On the other hand, the development of phosphate of lime in this locality has been very extensive, and there are undoubtedly enormous reserves yet untouched. It is possible that, with more up-to-date appliances and more scientific methods, these deposits can be exploited and operated profitably.

Investigation has established the fact that the pyroxenite dikes of the region are directly associated with the occurrence of phlogopite, or amber mica, which has been mined actively for many years. The mica may occur in pyroxene rock near the contact with gneiss; along the contact of pegmatite or diabase dikes cutting pyroxenite; or in pyroxenite dikes cutting crystalline limestone. There are, roughly, three modes of occurrence: (1) pocket deposits, (2) fissure deposits, and (3) contact deposits. Most common are the first. The other two are very similar in form and general characteristics. The true fissure type, however, usually occurs in pyroxenite, the third type being found along the contact of pyroxenite and calcareous gneiss, or crystalline limestone.



Hand drilling operations at a graphite property

Nearly all of the deposits are erratic—a property that they share with mica deposits the world over. Mining, with one or two exceptions, is generally carried out by small operators who often simply "gopher" out the available mica, and do not bother with any exploration beyond surface prospecting.

The pegmatites of the region are undoubtedly the major source of the mineralization. The connection between them and the origin of the apatite deposits has not been clearly established; but there appears to be no reasonable doubt that they are intimately related. Contact deposits of mica, with the development of calcite, and apatite, where pyroxene rocks have been intruded by pegmatite, are too obvious to need comment. The dikes themselves are the sources of muscovite mica, feldspar, and quartz, all of which have been extensively mined in the district.

Numerous pegmatitic intrusions present a number of phases, grading from a fine-grained intimate admixture, more granitic than anything else in texture, to the huge, giant pegmatites which are the sources of the minerals referred to above. The latter are not so common to the mica-apatite area as the finer-grained types, and the mineralization of areas adjacent to the intrusive pegmatites—such as the formation of apatite, mica, and calcite in pyroxenite, and of graphite in calcareous gneiss—appears to be almost entirely confined to the finer grained, or more granitic, phase. Herein, only the development of the giant pegmatites as sources of the three economic minerals already mentioned will be considered.

Speaking generally, muscovite mica is not as common a mineral as might be expected among such a profusion of pegmatite. It has been worked at a number of places; but the only mine of actual note is the Villenueve, which was, in its day, a most remarkable deposit. This mine is situated on one of a series of parallel dikes. The dike mass consists of an intimate mixture of microcline, albite, and quartz. Distributed through this are crystals of muscovite of various sizes. Tourmaline is abundant, and specimens of pitchblende, and its alteration product gummite, have been found. The mica from this deposit is of particularly good quality. This mine was for many years a source of dental spar, and also of "quartz asteria," or, as one old-timer termed it, "hysterical quartz." A large number of the dikes throughout the region carry mica, but it is usually too stained and too distorted to be of commercial value.

The so-called feldspar dikes of the Buckingham district are, of course, a phase of the normal pegmatites. They are characterized by a large-scale segregation of the quartz and feldspar, and are distinguished by the fact that there is practically no admixture of the two minerals. The crystallization is on an enormous scale, individual members sometimes being so large that their crystal formation is difficult to trace. Accessory minerals are tourmaline, mica, and pyrite, with some chlorite. Mica is not found to any large extent in the development of potash feldspar in this district.

Feldspar shipped from the Buckingham district is of excellent quality. It ranges from an almost pure white to a buff-cream shade. It is high in potash, running around 13 per cent K_2O. Practically the entire output is shipped in its crude state to Rochester, N. Y.

The initiation of feldspar mining in this district began only a few years ago, at which time the development of the industry on a large scale was freely predicted. It has been found, however, that dikes carrying high-grade feldspar that can be won economically are scarce, and out of a number of exploitations only three have been operated profitably to date. The trouble lies in the contamination of the feldspar by accessory minerals, rather than in any

scarcity of the mineral itself. Thus, though dikes carrying large masses of feldspar are fairly plentiful, they are too often stained along the cleavage planes, which renders their exploitation unprofitable. Rusty staining along the cleavage planes is a common feature of the deposits on the surface; this is undoubtedly occasioned by the permeation of surface waters. It is sometimes possible to get below the stained zone into clean feldspar. At other times, the dikes display a loose texture, and this staining seems to persist indefinitely, rendering the deposit valueless.

Quartz is won as a byproduct in the mining of feldspar, though in certain places it is specially mined for a local market.

The district under discussion has probably received more public notice for its occurrences of graphite than for those of any other mineral. Graphite occurs here in the massive crystalline form, and, also, as flakes disseminated through rocks of a gneissose and calcareous nature. The latter is the usual form, the former being somewhat rare, and of no commercial importance. Development of the disseminated deposits is always associated with some intrusion of a granitic, or pegmatitic, character, and they are usually distinctly local in occurrence, though what might be termed graphitic bands are common.

Reference has already been made to the bands of zones of calcareous gneiss that are so characteristic of the complex geology of the region. Where these are intruded by the numerous pegmatites, the formation of graphite orebodies, of varing size and richness, has often occurred. Thus there will frequently be a distinct trend to series of graphite deposits, corresponding with the general strike of the zone in which they occur. This has given rise to the erroneous description of these deposits as graphite beds. As a matter of fact, graphite flakes can often be observed through the bands of calcareous gneiss over long distances. These are of too low a grade to warrant economic development. Rich ore is only found adjacent to the igneous intrusions, and its occurrence is entirely local to them.

Graphite Orebodies Irregular in Shape and Size

Obviously, under such conditions, the orebodies themselves are bound to be irregular in shape and size. In occurrences where the calcareous band is narrow, a vein-like appearance is often manifest—the igneous intrusive forming one wall and the non-calcareous gneiss the other. This condition has served to strengthen the conception of the deposits as being more or less continuous. I have noticed that, in this class of deposit, the ore is usually higher grade than in any other—the conversion of the carbonate to carbon, as graphite, having been very complete. In others, where the calcareous band is wide, the vein-like structure is entirely lacking. Usually the ore nearest the igneous contact is the richest, gradually grading into lean, and eventually into barren, rock.

It is reasonable to assume that the graphite in this district is formed by the liberation of carbon dioxide through the agency of the intrusive, with subsequent reduction to carbon in the form of graphite.

The graphite ores of the Buckingham district run from about 8 per cent to over 20 per cent graphitic carbon. I know of one orebody that averaged 28 per cent. From 12 to 15 per cent, however, may be accepted as characteristic of this area. The occurrences are widespread, and a very large quantity of the mineral is available.

Graphite has been exploited, more or less spasmodically, for more than 70 years in this region. So far, it has not been a successful industry. For many years no really satisfactory process of extraction was evolved. It was not until the Great War that the flotation process was adopted for the concentration of this mineral. This solved the problem of concentration in a broad sense; but the business depression and general dislocation of affairs, subsequent to the war, practically killed the industry. The problem resolved itself from a technical to a business one.

Another graphite operation in the district

Since conditions have become more normal, attempts have been made to revive graphite mining in the Buckingham district. There is every reason to believe that the near future will witness a revival of the industry, and that it will, at last, become successful. Cheap electric power is now available. This, with refinements in treatment processes, and the availability of the high-grade ores of the district, seems to indicate that the Buckingham graphite fields are to become an important factor in the world's production of the mineral.

A Cheap and Satisfactory Metal Cleaner

ORTHO-DICHLOROBENZENE, a chemical obtained as a byproduct in the chlorination of benzene, and for which only limited commercial applications have heretofore been known, may be made the base of an excellent metal cleaner and polish, according to P. H. Groggins and Walter Scholl in the September number of *Industrial and Engineering Chemistry*. The chemical mentioned, which is a liquid selling wholesale for 6@10c. a pound, is made into a paste by adding one part of precipitated chalk to five parts of the ortho-dichlorobenzene. It has been tried on copper plates and pipes, nickel-plated automobile radiator shells, and on silver and aluminum ware, with uniformly good results, in most instances surpassing those obtained with proprietary preparations selling at several times its cost. The chemical is a solvent for the oxides of the metals mentioned, having no effect on the metal itself; the addition of the chalk makes possible a higher polish.

Mining Development in the Belgian Congo

Abstracted from an article in "Commerce Reports," with supplementary data

THE only province in the Belgian Congo that is important at present for its mineral production is the Katanga (particularly the Haut-Katanga), which lies in the southwestern corner of the Congo, and has an area of approximately 650,000 square miles, with a white population of about 2,600. It is connected with the South African coast ports by direct railway lines and with Leopoldville and Boma, on the west coast, by river and railway, and by an airplane mail service. An additional railway line from Lobito Bay, Angola, to the Katanga is gradually pushing its way to the Angola-Congo frontier.

In 1926 the Union Minière du Haut-Katanga invested over 144,000,000 francs in construction work and over 107,000,000 francs in material and supplies. From the date of foundation of the company to Dec. 31, 1926, 425,000,000 francs has been spent. The copper-mining activity of the company has been concentrated at the Kambove and Etoile mines until recent years, when the Ruashi mine was opened. At present nine copper mines are operated, of which the Kambove produced 563,403 metric tons of ore in 1926, the Ruashi 422,861 tons, and the Likasi 134,995 tons. Both reserves of copper ore and the average copper content of the ore continue to increase, as shown in the following table:

Copper Industry of Haut-Katanga in Recent Years

Year	Reserves of Copper Ore, End of Year, Metric Tons	Copper Content, Metric Tons	Percentage Copper Content	Copper Production, Metric Tons
1920	32,300,000	1,869,500	....	18,962
1921	46,348,000	2,812,810	....	30,464
1922	53,900,000	3,340,000	6.20	43,362
1923	72,666,000	4,802,000	6.41	57,886
1924	74,686,600	4,998,000	6.69	85,570
1925	76,892,943	5,285,640	6.87	90,104
1926	77,160,650	5,317,853	6.89	80,639

The value of the copper content of the known ore reserves, at 13c. per pound, would be about $1,700,000,000.

In addition to copper the Union Minière also produces tin, cobalt, and radium. The Katanga is said to claim first place as a producer of cobalt and radium and third place in copper and diamonds. There are important deposits of tin and gold as well.

Union Minière is now exploiting eight deposits and 220 have been located on its territory. At the end of 1926 it had 1,730 white employees, compared with 1,500 at the end of 1925. Black labor, on the other hand, decreased as better equipment was installed.

The company began plans for the reduction of its copper ores in 1908, and before 1918 seven water-jacket furnaces were installed at the Lubumbashi smelter, with an output of 40,000 metric tons of copper per year. These installations were suitable for treating rich ores only. Later a large concentrating plant was set up at Panda, which, in 1925, treated 1,113,963 metric tons of ore, giving 198,558 tons of concentrates with a copper content of 22.04 per cent. A copper leaching plant was also installed and in 1925 treated 15,062 tons of ore, producing 1,362 tons of cathodes. Other installations for handling and washing ores have also been operated successfully. The copper production of the company rose from 977 metric tons in 1911 to 28,462 in 1917; then declined during the years immediately succeeding, but advanced again to 30,464 tons in 1921, 57,886 in 1923, 85,570 in 1924, and 90,104 in 1925. In 1926, however, the figure fell to 80,639 metric tons. Copper production made a new record in October, 1927, when between twenty and twenty-one million pounds was produced. The increase in output has been accompanied by a constant addition to the white personnel and a smaller increase in native labor.

Exports of gold from the Belgian Congo increased from 3,687 kilos in 1925 to 5,352 in 1926. Union Minière possesses a gold mine at Ruwe which produced 112 kilos of gold in 1907 and similar amounts in the two years following. The mine still holds good gold reserves, but, owing to the difficulties of transportation, it has been abandoned until it becomes possible to bring modern machinery into the region.

The exploitation of tin mines by Union Minière was first studied in 1912, and production began in 1920 with 340 metric tons of cassiterite. Output increased gradually to 854 tons in 1925 and dropped again to 711 in 1926. These ores are treated in Belgium by the Société Générale Métallurgique de Hoboken.

In 1924 installations were set up on the Congo for treating the cobalt-copper ores of the Luushia and Ruashi mines. Three electric furnaces, with a total production of 150 tons of alloy per month, were installed; 975 tons of alloy were forwarded to Europe in 1924 to be treated at the Oolen plant of the Société Générale Métallurgique de Hoboken, and in 1925, 683 tons were handled. In 1926 the production of the Oolen plants amounted to 300 tons of cobalt in the form of metal, oxides, and different salts.

In addition to the minerals mentioned, Union Minière produces radium from ores extracted from the Chinkolobwe mine. These ores are treated at the Oolen plant, in Belgium. Radium production amounted to 22 grams in 1924, 20 grams in 1925, and 20 grams in 1926.

Exports of diamonds from the Belgian Congo rose from 764,765 carats in 1925 to 1,076,113 in 1926.

Preparation and Technical Applications of Beryllium

DR. ILLIG has given an account (*Z. angew. Chem.*, abstracted in *Chemistry and Industry*) of the preparation and uses of beryllium. The production in quantity is based on an electrolytic process, worked out by Stock and Goldschmidt in 1925, using a fused sodium-barium-beryllium fluoride as electrolyte. The Siemens and Halske A.-G. has now developed this method, and can put the process on a technical scale as soon as a demand exists. It is estimated that the present price of 6 to 11 shillings per gram would fall to approximately that of silver with increased production.

The properties of beryllium have proved surprising. The pure metal melts at 1,285 deg. C., is very hard and brittle, and resistant to the atmosphere. It has already found a limited application in the construction of X-ray tubes. Its chief use will, however, be in the form of alloys. The addition of 2 per cent to iron increases the hardness from 100 to 300, and this may be further increased by heat treatment to 500 to 600. With copper or nickel a beryllium content of 2 to 3 per cent yields alloys closely resembling bronze in their properties. They have the advantage that they can be worked prior to heat treatment. These alloys are more resistant to corrosion than carbon steel. In their production the use of cheaper, poor-quality metal containing 10 to 20 per cent of aluminum has proved entirely satisfactory.

DISCUSSION

In Appreciation of John W. Mackay

THE EDITOR:

Sir—John W. Mackay's name, like that of Abou Ben Adhem, "led all the rest" in the history of Nevada. Not only as a great miner and organizer, but as a generous, straightforward, high-souled man, who remained himself even when the flood of gold and silver from the "Con. Virginia Bonanza" made him, within the space of five years, one of the richest men in America; whose quiet charities were innumerable, and whose helpfulness to old-time friends knew no diminution.

As a boy in Virginia City, I recall him as he walked to and fro from the Con. Virginia mine; a stalwart, deep-chested, reserved man, who usually walked alone; a self-reliant yet modest figure. He was abstemious to a degree, and took no part in the high living and conviviality that characterized those times; yet he was revered and respected above all other men, excepting only Father Manogue, the Catholic priest, who, for a generation, was the greatest power for good throughout Nevada. These two great men were life-long friends, and it is not too much to say that had their training been reversed, either could have filled the place of the other.

Your readers may be interested in a few reminiscences:

Mr. Mackay and Jack O'Brien walked over the Sierras from Downieville to Virginia City about the year 1860. As they sat down to rest on a rock overlooking the town, Jack said, "John, I've only got a half a dollar and I'm going into town like a gentleman," and he threw that last fifty-cent piece far down the hillside into the sagebrush. O'Brien was a great-hearted, convivial soul, whose habits and temperament forbade advancement, but Mackay looked after him until his death, many years later.

Times were hard and work was scarce during that first winter in Virginia City, and Mackay, O'Brien, Kinney Said, and Alex Kennedy lived in a little dugout cabin on the hillside. Their meager earnings were soon exhausted, and, after running up a small bill at the butcher's they tightened their belts and went without meat. The butcher asked Mackay one day why he did not trade with him any more. When John hesitatingly explained, the butcher said, "You boys come and get what you want and pay me when you can." Needless to say, that butcher was rewarded in the days of prosperity, which were not long in coming to Mackay.

Years afterward, when Mr. Mackay was living at the Palace Hotel in San Francisco, a woman, plainly dressed, and accompanied by a young girl, called upon him to ask if he could not help the girl to find employment. When he learned that they were the widow and daughter of his old-time butcher friend, tears came to his eyes and he almost took them in his arms. Want was never their portion thereafter.

There was fierce rivalry among the mine managers along the Comstock lode, and John Mackay, starting from the bottom, early determined to overtop them all. He succeeded beyond his fondest dreams. Fortune favored him, to be sure, but his was no "one-mine success." Long before the discovery of the "Big Bonanza" he had proved himself a man of vision and of indomitable will, and had made an enviable record as a successful miner and operator.

The great Con. Virginia orebody, discovered in 1873, had its apex a thousand feet below the surface, and stood in a vertical crack in the hanging wall of the Comstock Lode. In its greatest dimensions it was approximately one thousand feet in length, three hundred feet in width, and extended seven hundred feet in depth. From this great bonanza one million tons of ore were extracted that yielded $100 per ton in silver and gold. No such mining had ever been done in the world before, and enough timber went into that cavern, as the ore was extracted, to build a city.

The danger of fire and the fear of a great caving of the ground were on Mr. Mackay's mind night and day, and he was almost constantly in the mine. To his great credit be it said that not a life was lost in the extraction of that ore and that no fire occurred.

It was Mr. Mackay's custom to walk down the hill to the hoisting works every morning when the 7 o'clock shift changed. On one of these mornings he met a bare-footed boy, crying with the cold. Promptly he handed him a five-dollar gold piece and told him to go and buy a pair of shoes. Lo and behold! the next morning the road to the mine was lined with bare-footed children.

When a circus came to town— O glorious memory!— Mr. Mackay was always on hand to see that every boy got into the tent. He would arrive with his overcoat pockets filled with silver dollars, and, slipping around among the boys, would press one of these into the hand of each. The boys soon learned to anticipate Mr. Mackay, and would hang about the tent door in droves, waiting to have the price of admission pressed upon them.

In later years, in San Francisco, it was Mr. Mackay's custom to go to the Nevada Bank every morning and get ten five-dollar gold pieces to meet the requests for assistance that were inevitably made upon him. Very often indeed this store of gold would have to be replenished before the day was over.

Joe Stuart was the leading high-toned gambler of Virginia City; a distinguished looking man, of irreproachable manners and many fine qualities. He and Mr. Mackay had been friends in their younger days in Downieville, and that friendship continued during their lives. It required a very large capital to keep Stuart's faro games going. Under ordinary conditions he could go to the bank and borrow many thousands of dollars on his own note, but, at one period, the games had an extended run of bad luck and he called upon Mr. Mackay five times, in the course of a month or two, and borrowed $10,000 each time. The only reproof he received, if it can be called that, was, when he borrowed the last $10,000, Mr. Mackay, who had a slight impediment in his speech, said quietly, "Joe, w-what's your l-limit?"

Mackay's generosity to old-timers was boundless and continuous throughout his lifetime. No one ever heard of his denying a friend of former days, despite impositions that would have soured a saint. His confidential secretary alone knew the names of all of the recipients of his bounty, and that because it was his duty to see that stipends were regularly paid.

One day, many years before his death, Mr. Mackay went to his physician for an examination and received a somewhat unfavorable report. His confidential secretary told long afterward that Mr. Mackay went straight to his office, opened the safe, and burned almost $1,000,000 worth of notes and I.O.U.'s, saying that if anything happened to him he did not want his executors to trouble those people.

In mining history there is no equal to Mr. Mackay's achievement in the conduct of the affairs of the Con. Virginia and California mines, both of which operated on the big bonanza orebody. Not only was that great body of ore extracted without loss of life and without a great fire, but those two companies, during the period from 1873 to 1879, inclusive, paid in dividends the sum of $73,310,000 out of a gross production of $101,707,608.39.

Mr. Mackay's practical genius was again demonstrated when he removed to New York and founded the Postal Telegraph & Cable Company, of which his son Clarence remains the president and controlling factor.

San Francisco. GRANT H. SMITH.

[Despite editorial vigilance and the faithful observance of the technique of publishing, an error now and then will contrive to get itself into print. An instance is recorded in our issue of Nov. 12, wherein "John W. Mackay" appears under the effective disguise of "William H.," and his son's name is given as "Clarence M." instead of the correct form, "Clarence H." To all whose sensibilities were unpleasantly affected by these lapses, acknowledgment of culpability is made. *Engineering and Mining Journal* regrets the mistakes, even more so than do those who have been so kind as to direct attention to them. As a distinguished journalist once remarked: "A man's name is about the only thing that really belongs to him. It should be given correctly."—EDITOR.]

* * * *

Has Engineering Inventive Genius Reached Its Limit?

THE EDITOR:

Sir—I have read with much interest the letter by Mr. Nicol on the "Future of Dredge Mining" and shall watch with even greater interest for whatever suggestions may be forthcoming in the replies. I am not an engineer, and in fact my technical knowledge on the subject of dredge mining is limited, and I have therefore to be guided by others. Some business associates and I own a tract of river channel over 10 miles long which cannot be worked by ordinary methods. Tests and different reports have been made showing ground averaging above 60c. per cubic yard, and many sections showing several dollars to the yard and here and there test pits giving $10 and over per cubic yard. One engineer estimated that the river would give approximately a million dollars to the mile or better.

Competent engineers state that it cannot be dredged by any form of standard gold dredge, owing to hard bedrock and occasional zones of fairly large boulders. Work with a steam shovel during one short period of low water showed conclusively that the digging power of a shovel was quite capable of going through the ground, but lack of mobility of the plant as a whole, problems in saving and stacking, and the like showed that some new form of dredge was required.

Has engineering inventive genius reached its limit? Is this wealth to lie idle for want of a means to work it? I shall be interested in hearing what your other contributors have to say; what the experience of others may be; and what suggestions are offered. PLACERITAS.

San Francisco.

* * * *

Shall Mining Abroad Be Barred to American Investors and Engineers?

THE EDITOR:

Sir—Sunday newspapers recently carried a Washington item from which I quote the following:

"So it seems likely that the State Department may presently be called upon to decide whether it would be willing to give its sanction to loans from private American bankers to European industrial combinations designed to wage a concerted European warfare against American export trade in Latin America and in the Orient." The correspondent closes with: " . . . and more public supervising of the export of American dollars."

Some time ago—shortly after the close of the war—I called attention to the similar condition, in these words: "American capital, along the Atlantic Coast, stands with its back to America and its pocketbook reaching out in the development of mineral resources in foreign lands," while the cry of the West was for money for development.

Loans to foreign countries to build up export trade and wage commercial war against American trade do not constitute the only menace incidental to the present rush in "export of American dollars" to foreign countries. Another phase has a twofold threat underlying it.

It is hard to understand what manner of citizens, what manner of patriot at heart is the man, or what sort of citizens comprise the group of men, who will take the profits of American industry and, forming an alliance with a foreign country, pledge himself, his associates and his money—or pledge themselves—to the development of resources that are not only a menace to the industries of this country, through trade competition, but which put into the hands of such a foreign government war materials without cost or risk to that government. Is it lack of patriotism, lack of foresight, or, both—blinded by greed? The while American money is going to foreign countries to develop these assets of militarism, development at home lags, finance is lacking, and the government is put to the consideration of ways and means of providing against future contingencies. I refer to the development of foreign manganese, of foreign lead and zinc, of foreign copper by American capital from the profits of American industry.

I do not disclaim the right of American capital to seek investment in foreign lands; but, in recent years, the obvious intrigue between some American capitalists and several foreign nations has become brazen and has been undertaken with utter disregard not only for American trade but against the welfare of the nation, should another war be precipitated.

Are these interests, who stop at nothing, even risking the rupture of diplomatic relations between those nations and this country, so blind to everything but the profits to

be derived from "cheap" labor, that they forget country—forget, or fail to foresee, their own undoing in the event of such a war as that through which the world recently passed? Are they blind to the covert wink of the shrewd diplomats who, they congratulate themselves, are bestowing upon them a gratuity? Let them recall England's experience with her investments in Russia and what it cost her since the war in effort and money in futile attempts to recoup something on her citizens' pre-war investments.

It is time that the American people take cognizance of this "export of American dollars" as well as those which go to threaten industry, manufacture, and American labor. The American people owe a duty to themselves and to the industries built up in this country, and, as well, a duty to future generations by way of protection against the contingencies of another war.

Helena, Mont. LEVERETT S. ROPES.

* * * *

Iron Ores of Brazil

THE EDITOR:

Sir—The article by Emilio Teixeira, of Brazil, on the iron ores of that country was read with great interest.

Dr. Teixeira is a graduate of the University of Illinois and a fine example of what American education does for the ambitious, intelligent Brazilian who sees and values the immense mineral resources of his country. He acted as the superintendent of chromite mining operations, under my management, in Bahia, during the war. He observed and assisted in the mining of manganese ores, associated with the ferruginous schists, in the Bom Fim Saúde, and adjacent districts in the Jacobina range in Bahia.

Brazil, as will be seen in the article, has *started* utilizing its iron ores. Real progress will depend on both Brazilians and foreign well-wishers. The Central Railway of Brazil is too long, too crooked, and its coastal terminal at Rio de Janeiro unsuitable for extensive use in transporting iron ore. The Farquhar concession, long debated in Brazil, might have corrected these features by proposed railroad construction. Its provision for a "zone" free from Brazilian influence, or nearly so, sounded too much like a "Canal Zone" to suit the situation. A German concession that was seriously considered was finally dropped.

Germany, England, America, and Italy are much interested in the iron-ore possibilities in Brazil, but all, so far, have failed to consider carefully the temperament of the average Brazilian man of affairs. The states of Rio de Janeiro, São Paulo, and Minas Geraes have certain jealousies, much like our states that are involved in the Boulder Dam question.

In Bahia, in Goyaz, as well as in Minas Geraes (usually thought of as the iron-ore state), are iron ores of importance, possible of economical development. There are also valuable deposits north of Bahia, south of Minas Geraes, and west of Minas Geraes. Of iron ore in Brazil there is no lack.

Of water-power there is an abundance. Of fluxing material, the same may be said. Of coal that can be used there is a very little. Therefore the ore should be brought to the coast and English and American coal used. Petroleum and shale oils will be available in Brazil's interior some day. It seems far distant now.

Brazil is a loosely knit consolidation of states. A large part of the revenue of, say, Minas Geraes, is derived from export taxes to another state or to a foreign country. This tax is liable to sudden changes, by decree. The resulting uncertainty, the railroad and fuel situation and the jealousy of several states combine to delay the iron-ore industry of Brazil.

In conclusion I wish to commend Mr. Teixeira's article. It is temperate, full of valuable suggestions, and accurate, in my opinion. W. H. STAVER.

Jackson Heights, N. Y.

* * * *

Economic Position of the Metal Producers of the United States

THE EDITOR:

Sir—If one were asked as to the relative prosperity of producers of copper, lead, zinc, and silver in the United States, it would not take a great deal of thought to venture the suggestion that producers of lead were probably in the most favorable position, for, even considering the recent decline of around three cents per pound in the price of that metal, it is still almost half again as high as before the war. In other countries, however, producers of lead from ores of similar grade to those worked in the United States, are not looked upon with any particular envy, the London quotation of close to £20 per long ton affording little opportunity of profit to many operators. To what, then, shall the more favorable situation of lead producers in this country be attributed? Without doubt, to the fact that an effective protective tariff is levied on this metal, thus making it possible for domestic producers to obtain up to $2\frac{1}{8}$c. per pound more for their product than the lead producer in other countries, and thus to mine lower-grade ores. Considering the protection that is afforded to manufacturing interests in the United States, and the resultant high-price scale that obtains in this country, the protection afforded to the lead producers is no more than right, if the production of raw materials is to be encouraged.

Producers of copper, zinc, and silver, however, are in another category; they are sufferers from the present economic situation in that they produce more than is consumed in this country and the price of their product is that of the world market. They cannot benefit to any extent from tariff protection as can the lead producers, who do not produce enough to supply the lead requirements of the country. The following table, compiled from data supplied by the government and the American Bureau of Metal Statistics, makes the situation clear. The figures given are obviously in round numbers only, and represent monthly averages for either the first eight or nine months of 1927:

Monthly United States Production, Imports, and Exports

	Production	Imports	Exports
Copper, tons	80,600	31,500	47,700
Zinc, tons	51,300	1,100	5,100
Silver, oz	4,900,000	8,000,000	11,200,000
Lead, tons	57,500	14,100	10,100

Though the lead consumption is not markedly greater than the United States production, the 4,000 tons or so a month that is required from foreign sources makes it possible to make the tariff effective. There is also a tariff on zinc that has a slight effect on domestic prices, owing to the fact that most of the exportable surplus of that metal is of quality known as High-Grade; the domestic Prime Western supply is just about equal to the demand.

Under these conditions the unfortunate position of the copper, zinc, or silver producers cannot be relieved through a protective tariff comparable to that which most

manufacturing interests enjoy. Producers of those metals must pay wages artificially maintained through restrictive immigration laws, beneficent though they may be from most other considerations, and most of the supplies and equipment they buy are more expensive than they would be in the world market. They are thus at a disadvantage with producers in other countries so far as the cost of their product is concerned, and other means than the tariff must be found if maximum production from domestic mines is desired and if the mine owners are to be permitted to enjoy a fair share of the country's prosperity. At present, most of the important ones are continuing operations on a large scale in an effort to keep down overhead costs, because they have the productive capacity, and without regard to depletion of assets in many operations. The small producer and the developer of prospects is gradually being forced out of the picture. Some metal is actually being exported at less than the cost to produce, if all fair expenses of interest and depletion be taken into consideration, a gift of natural resources thus being made to foreign consumers who pay only the bare cost of recovery and delivery. The situation is not unlike that which obtains in some branches of the agricultural industry, and for which many panaceas have been suggested. The farmers have had much more publicity for their troubles because their voting power has commanded the attention of politicians.

To point out the condition is easier than to suggest a suitable remedy. Some time ago the copper producers endeavored to improve the situation by forming an export association under the Webb Act. This has in part fulfilled its avowed intention of preventing daily fluctuations in price, but it has not prevented a considerable decline in the general price level. Before the association was formed it was argued that a sudden decline in the London price, alleged often to be the result of manipulation, scared off buyers in this country, and weakened the market. But evidently buyers were not refraining from buying solely because of fluctuations downward in the London price. They stay out of the market with just as much firmness now, even though the foreign price is steady and when there seems no immediate probability of price concessions here. Now, the copper producers are taking another step—forming a so-called Copper Institute, making it possible for producers to meet, talk over their interests, exchange information, and thus have the requisite data for deciding on policies for the good of the industry.

Even though it were permitted by law, no association of producers in the United States could help the market for copper and silver much by limiting the domestic output, for it would be necessary to control a far larger proportion of the world's production. In other words, foreign producers would be inclined to run to capacity and take advantage of any increase in price secured by a curtailment of production in this country. But it would apparently be feasible to curtail zinc production sufficiently to make the present tariff effective in raising the price to the full tariff differential. That is, if the domestic production were cut to the extent of the exportable surplus, say about 4,000 tons or a little more per month, it should be feasible to bring the domestic price up to around 7c. per pound, with London at £26. A much larger proportionate cut would have to be made in domestic copper production to eliminate the exportable surplus: instead of producing 80,000 tons per month, the output would have to be cut to something like 60,000 tons, and, further, a tariff would have to be put on the metal, to make domestic prices higher than those in the world market. The exportable surplus of silver appears to be so large that consideration of limitation of output and tariff protection seems out of the question.

Any combination of interests that results in limitation of output to enhance prices will run afoul of the Sherman Act, though combinations of manual workers and of farmers are exempt from its provisions. Modification of the severe provisions and interpretation of the Sherman Act could conceivably be of great aid to the zinc producers in permitting them to take advantage of the tariff protection already allowed them. Copper and silver producers perhaps have less to gain, but should be given every advantage possible in co-operative marketing, for they must, under present conditions, meet a world competition, though producing in a country with a high protective tariff. If it is to be a matter of national policy to discourage the production of raw materials in the United States and to make this preeminently a manufacturing country, then there can be little hope of much improvement in the situation. But if metal production is to be encouraged, more privileges should be allowed in the way of co-operative effort.

New York City. R. H. EDWARDS.

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Applied Geophysics

THE EDITOR:

Sir—The National Research Council's associate committee on mining and metallurgy has for some time had under consideration the preparation of a bulletin on applied geophysics, since there appeared to be a considerable demand for some work in English on this subject. After considerable progress had been made in the preparation of such a bulletin, we learned from Dr. Richard Ambronn, of Göttingen, Germany, that there was in preparation an English translation of his book on Methoden der angewandten Geophysik" ("Methods of Applied Geophysics"). Since the German edition of this book covers very much the same ground that our proposed bulletin was intended to do, and contains an excellent bibliography, the Research Council considers it inadvisable to issue a bulletin on this subject at the present time. A letter recently received from Dr. Ambronn is to the effect that the English translation of his book will include all the latest advances made since publication of the German edition and that it is about to appear.

We may mention that there is in preparation in Germany another book on geophysics even more suitable for students and those primarily interested in the principles involved. This is "Lehrbuch der Geophysik," by Prof. B. Gutenberg, and published by Gebruder Borntreager, W. 35, Schonerberger, Ufer 12A, Berlin, Germany. This work, which is a textbook of geophysics, is being issued in five parts, four of which have already been published.

Ottawa. F. E. LATHE,
Technical assistant to the president,
National Research Council, Canada.

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Manitoba Mining Chamber Co-operates

THE EDITOR:

Sir—With reference to the article in your publication of Nov. 5, dealing with inquiries re mining companies, may I say that the Manitoba Chamber of Mines will be glad to furnish information upon any properties situated in Manitoba.

Montreal, Nov. 16. L. D. M. BAXTER,
Managing Secretary.

NEWS OF THE WEEK

Summary

SEVEN MEN are killed in $500,000 shaft fire which burns out the timbering between the 2,250 and 1,600 levels of No. 2 shaft of the Magma Copper Company's mine at Superior, Ariz.

* * *

Trading on the Standard Mining Exchange of Toronto continues to increase, amounting to 2,000,000 shares a day during November, and reaching a record high point on Nov. 14, when a total of 3,686,386 shares was traded.

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Many prominent men in the mining industry are included in the membership of six committees recently announced by the American Manganese Producers' Association.

* * *

An appeal from the decision of Judge Bourquin, of Montana, is presented by the Carson Investment Company before the U. S. Court of Appeals at San Francisco.

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Opening of a carbonate lead-silver orebody in the Cardiff mine stimulates interest in the exploration of the Cardiff overthrust contact at Alta, Utah.

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Two brokers arrested in connection with raids by the Attorney General's Department of Ontario are each sentenced to two years' imprisonment.

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First 500-ton unit of the Noranda Mines' smelter is practically completed and will most probably be put into operation by Dec. 15.

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Mexican government states that during the period of August, 1926, to July, 1927, only 26 mines of importance were shut down.

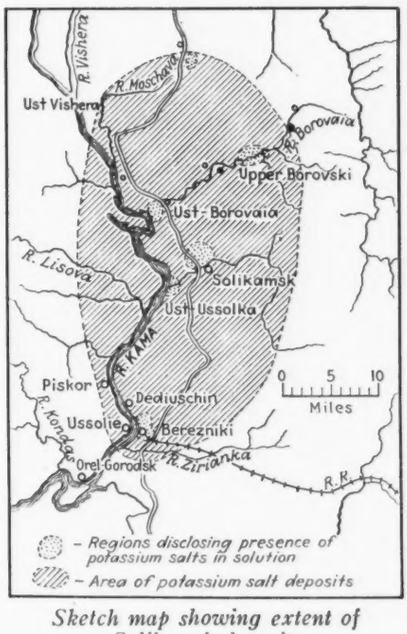
Russia to Exploit Potash Deposits at Solikamsk*

Extent Makes Them of World Importance—Commence at Depth of 95 Meters and Continue to 200—Ground Broken on Nov. 7 for First Mine in the District

By Professor D. I. Mushketov
Director of the Russian Geological Survey

THE EXTENT of the recently discovered potassium deposits at Solikamsk, Russia, gives them world-wide importance. The town of Solikamsk, which is the center of the region in which the potash deposits are located, is situated on the left bank of the Upper Kama at the foot of the eastern slope of the Urals, somewhat north of the city of Perm.

Exploitation of salts in the region dates back to the reign of Ivan the Terrible, in the sixteenth century. Salts occur there in shallow wells in the form of a brine, which is pumped to the surface, reduced to the density required, and evaporated in large vats. The crystals of sodium chloride which are formed have been to this day the sole product of exploitation.



Sketch map showing extent of Solikamsk deposits

Since the earliest days of exploitation of the wells great curiosity existed as to the cause of the salt solution. It was not until 1922 that Prof. A. Chernov, after some geological researches, put forth the hypothesis of the existence of beds of rock salt at a considerable depth as the true cause of the presence of brine in the wells. He thought that these beds were of a possible commercial importance and directed the prospecting of the section by borings. The researches were carried on for a few years, but because of insufficient funds the work lagged. In 1925 the undertaking was renewed with considerable vigor, P. Preobrajensky, a geologist of the Russian Geological Survey, being in charge of field exploration. The work was amply rewarded by the discovery, together with the beds of rock salt, of huge deposits of potassium salts of different compositions.

The two great deposits which at present supply the world with potash salts for manures are those of Stassfurt, in Germany, and of Alsace, which has become French since the war. The reserves of these two deposits are considerable, and together with the deposits of Spain amount to two and one-half billion tons. These deposits are also of excellent quality, but they present the difficulty that the work must be carried on at a depth of 600 meters and at greater depths from year to year.

On the other hand, the workable deposits at Solikamsk are found at a depth of 95 meters and go down to a depth of 200 meters. In an area of six square kilometers in the immediate vicinity of Solikamsk, to a depth of about 200 meters, reserves of potassium oxide (K_2O) estimated at 68,000,000 tons were located. These results of the first drillings indicate an average of over 11,000,000 tons of the mineral to the square kilometer. Since then a boring made at Borovaya has given very satisfactory results. This indicates the existence in an area of 30 square kilometers between Solikamsk and Borovaya of probable resources surpassing 300,000,000 tons.

*Published through the courtesy of the *Economic Review of the Soviet Union.*

At the time that the question of the extraction of the salt at Solikamsk was being taken up a problem arose whether to construct a new plant at Solikamsk for treating the raw salts or to utilize the existing soda works of Liubimov and Solvay at Berezniki, some 30 kilometers away. It was finally decided first to make some additional borings at Berezniki, as the geological studies of the region indicated a strong possibility of meeting the prolongation of the Solikamsk bed at Berezniki.

This supposition was strikingly confirmed by the diamond drillings, which disclosed salts of the same character as the Solikamsk potassium salts, as well as beds of impure rock salt. Since the geological formations of the region do not disclose the probability of any fault or fracture between Berezniki and Solikamsk, the conclusion has been reached that the deposit, as far as it has been studied to this time, extends over a band of potassium-bearing earth between Oust-Borovaya, Solikamsk, and Berezniki and contains probable reserves of from 1,500,000,000 to 1,725,000,000 tons of potassium oxide (K_2O).

Extended Exploration Planned

By way of comparison it may be mentioned that the potassium deposits of Alsace, ceded to France by the Treaty of Versailles, occupy an area of 172 square kilometers and contain a reserve of about 300,000,000 tons of K_2O, whereas the Solikamsk deposits contain, per unit of area, four or five times as much. Hovewer, the deposits discovered so far by no means exhaust the possibilities of the region, and it is proposed to push researches under the direction of the Geological Survey as far as Cherdyn, from 90 to 100 kilometers north of Solikamsk. The geologists predict that here also no break in the deposit will be disclosed. In this event there seems little reason to doubt that the Solikamsk reserves, extending over a distance of 150 kilometers, will take on an importance comparable to that of the Stassfurt deposits.

On Nov. 7, ground was broken for the first mine at Solikamsk, to be called the Tenth Anniversary Mine. It is expected that by Oct. 1, 1929, the mine will be in active operation and producing mineral to be delivered to a treatment plant at Berezniki. Construction of a new treatment plant at Solikamsk is to be started soon, and, in time, it is expected to open a second mine at Berezniki. One mine will supply the domestic needs of Russia and the other the export trade.

The various methods of investigation, including geological researches, drillings, and gravimetric studies, give the following cross-section of the deposit: First, a bed of alluvial of varying thickness due to Quaternary and fluvial-glacial deposits; then, under a bed of rock salt at an average depth of 80 to 90 meters, is a bed of sylvine (called the upper bed) of from 8 to 20 meters in thickness; this rests on a zone of carnallite from 60 to 70 meters thick; under this is a bed of sylvine (called the lower bed) of 30 meters thickness; finally, a great bed of impure rock salt whose limit has not yet been reached.

The studies of the potassium salts have furnished valuable information regarding the sodium chloride deposits. They indicate that the exploitation of the extensive beds of rock salt by underground workings is impracticable on account of the impurity of the beds. In the future, as in the past, it will be necessary to resort to the method of evaporation of brine from the wells.

Explanation of Estimates

A figure of 11,467,470 tons of potassium salts per square kilometer was arrived at in the following manner: Considering an average thickness of exploitable beds of carnallite, with a potassium chloride (KCl) content of 20 per cent, at 35 meters there would be 35,000,000 cubic meters per square kilometer of area. Taking the specific gravity of carnallite as 1.8, the total tonnage would be 63,000,000, 20 per cent of which converted into potassium oxide represents 7,963,000 tons. The lower zone of workable sylvine (with 24 per cent KCl) has been estimated at an average thickness of 11 meters. The volume of 11,000,000 cubic meters, figuring sylvine at a specific gravity of 2.1, gives an equivalent of 23,100,000 tons of mineral, which converted into K_2O gives 3,504,470 tons. This figure added to the carnallite gives a total of 11,467,470 tons of K_2O per square kilometer. In this calculation only the beds containing at least 10 per cent of KCl have been taken into consideration.

The difference between the new deposits and that of Stassfurt lies in the fact that the latter does not contain a zone of sylvine but, on the other hand, contains beds of kieserite (natural sulphate of magnesium) and of polyhalite (a combination of potassium, magnesium and calcium sulphates), which have not been found at Solikamsk. This absence of sulphates and potassium and magnesium establishes the character of the deposits as more closely resembling those of Spain.

Preliminary researches at Solikamsk indicate that the sinking of shafts and the exploitation work will be attended by considerable difficulty caused by the moving sands and by the great amount of water present, especially in the Berezniki region. The presence of gas, a phenomenon well known in other deposits of potassium salts, has already been manifested in certain of the Solikamsk openings. This gas contains hydrogen sulphide and methane, which brings up the possibility of exploiting it for illumination.

Pre-War Consumption Low

The consumption of potassium salts for fertilizers in pre-war Russia was practically nil, principally because of their costliness. At the pre-war price of 60 rubles per ton they were beyond the means not only of the peasants but of even the majority of the proprietors of extensive areas.

To facilitate the transport of a large tonnage of fertilizers, an initial appropriation of 1,700,000 rubles has been made to extend the Perm railroad 34 kilometers from its present terminus near Berezniki to Solikamsk. This extension will take care of transportation for domestic consumption, as well as for export by way of Leningrad. It is estimated that the sylvine enriched to 30 per cent will cost about 9.15 rubles per ton at the mine, that the rail transport from Solikamsk to the port of Leningrad will add another 9.40 rubles per ton, and that the port expenses, such as unloading from cars, storing, and loading on steamers, will bring the total cost to 25 rubles per ton aboard ship.

The true solution of the export problem, however, is looked for in another direction. Another railroad is projected through Troitsk - Solikamsk - Cherdyn-Petchersk-Oukhata, whence water transport will be used. This proposed railroad, stretching for 410 kilometers, has been under discussion for some time under the name of the Kama-Petchersk line. It was considered indispensable in order to open up a region for exploitation which has abundant resources of coal, gold, silver, copper, manganese, iron, oil in the Oukhata region, great virgin forests, rivers abounding in excellent fish, and fur-bearing animals. With the discovery of the Solikamsk potassium deposits, the construction of this railroad becomes a necessity.

Magma Copper Shaft Fire Fatal to Seven Men

SEVEN men were killed in a fire of unknown origin which started at 4 a.m. on Nov. 24 in No. 2 shaft of the Magma Copper Company's mine at Superior, Ariz. The fire broke out at the 2,250 level and progressed up the timbered portion of the shaft to the 1,600 level. Water turned into the shaft at the 500 level extinguished the fire by 10 p.m. The total damage is estimated at $500,000.

John McMahon and Juan Branbila, on duty as hoist men at the top of No. 4 shaft on the 500 level, were fatally overcome by carbon monoxide gas. The body of E. Olmas was found on the 1,500 level of No. 2 shaft. Bodies of two others, Maki and Rintla, were found on the 900 level of No. 4 shaft. Of the seven killed, the bodies of two are missing—namely, those of Daley and Rodriquez. Daley was on a No. 2 shaft cage when it dropped to the shaft bottom as a result of the fire melting the hoisting cable.

Cinders falling on a mining party engaged in deepening No. 2 shaft led to the discovery of the fire. A mine rescue crew from Globe reported at the mine soon after the fire started.

Carson Interests Appeal Bourquin Decision

ON NOV. 21, 1927, the case of the Carson Investment Company, plaintiff and appellant, vs. the Anaconda Copper Mining Company, defendant and appellee, was presented before the U. S. Court of Appeals at San Francisco. Judge Bourquin of the Montana court rendered a decision in favor of the Anaconda Copper Mining Company and against the Carson Investment Company on Jan. 24, 1927, the case having been tried at Butte in October, 1926. The present action was an appeal from Judge Bourquin's decision. J. H. Miller and J. M. Zane presented the argument for the Carson Investment Company and A. E. Colson and Thorley von Holst for Anaconda. Each side was limited to about one and one-half hours' argument.

Outcome of Appeal Important

The outcome of the appeal is of great importance in that it promises to decide in a large measure present and prospective litigation which may involve payment of damages for infringement of the Carson patents on reverberatory smelting furnaces by the users of side-feeding reverberatory furnaces. The Court of Appeals reversed the decision in the Tacoma case of the American Smelting & Refining Company and found in favor of Carson and his associates. J. H. Miller made this decision of the Court of Appeals his principal argument for the reversal of the Bourquin decision. He held that the Court of Appeals had decided that the Carson patents were valid and that the lower court (Montana) should have been bound by this decision. However, the lower court ruled that the decree was not final, but was merely interlocutory. Miller also claimed that the lower court was in error when it refused to allow Carson to introduce evidence tending to show that the American Smelting & Refining Company and Anaconda had collaborated in the former case. He also claimed that if the decree is final it will determine the outcome of other suits.

Referring to the Siemens patent, he stated that the furnace there shown was different in principle and mechanical design; that the Siemens furnace never went into use at any time; that as soon as the Carson side-feed furnace was made known to the public it was universally adopted by all copper companies; that the Siemens furnace was inoperative, because of scaffolding, and that Siemens had invalidated his own patents by taking out later patents. Referring to the experimental furnaces built after the drawings of the Siemens furnace by Anaconda, he claimed that Anaconda had experimented with the furnaces for three months before informing the plaintiffs and that secret experiments are open therefore to suspicion.

J. M. Zane contended that the Dollar Bay prior use of side-feeding furnaces was entitled to a reasonable doubt based upon conflict between documentary and oral proof.

A. E. Olson, in replying to the appellant, stated that the decree of the Appellate Court in the American Smelting & Refining Company case is correct, as based upon the facts presented to the court at that time, but new evidence had been found and the conclusion of the lower court had been based upon this evidence. This evidence included the experimental proof of the workability of the furnace described in the Siemens patent of 1866; the fact that smelting of copper ores in reverberatories was in commercial use in 1866; that erroneous representation had been made by Carson before the patent office. In the American Smelting & Refining Company case, there had been no proof except as to opinion respecting the workability of the Siemens furnace, but since that time a furnace comparable with those employed in Siemens' time had been in operation for seven months. Olson described the several furnaces and discussed the merits of vertical and inclined side walls. Respecting the feature of scaffolding which was claimed by Carson as the important difficulty that interfered with the operation of the Siemens furnace, Olson stated that Carson had used pyrrhotite in his experimental furnace, and, because of the fusibility of this mineral, scaffolding had occurred. Olson claimed that the Patent Office had been misled in granting a patent which did not distinguish from prior art.

Thorley von Holst, also in reply to the appellant, stated that the facts relative to Dollar Bay furnaces had never been presented to the court. He said that this furnace represented a continuous use of a side-feeding furnace and was therefore a prior use of the Carson principle.

Miller, in rebuttal, called attention to the construction of a Siemens furnace by Anaconda in secret and its operation for three months before notifying the appellant, claiming that this action was by no means a fair one.

American Manganese Producers' Association Announces Committees

MANY prominent men in the mining industry are included in the membership of six committees recently announced by the general office of the American Manganese Producers' Association at Washington, D. C. The committees and the names of the respective committee members follow:

Tariff Committee—L. B. Miller, chairman, 920 National City Bank Building, Cleveland, Ohio; John H. Cole, president, Domestic Manganese Development Company, Milwaukee Depot Building, Room 1, Butte, Mont.; Joel Hurt, Jr., president, Georgia Minerals Company, 201 Hurst Building, Atlanta, Ga.

Research Committee—D. H. Mc Closkey, chairman, Brown Mountain Mining Company, Staunton, Va.; William B. Daly, general manager of mines, Anaconda Copper Mining Company, Butte, Mont.; Francis P. Sinn, assistant to the vice-president, New Jersey Zinc Company, 160 Front St., New York City; E. A. Fritzberg, superintendent, Trout Mining Company, Philipsburg, Mont.; Gaston Scott, secretary to the Governor of Alabama, Montgomery, Ala.

Finance Committee—A. J. Seligman, chairman, president Butte Copper & Zinc Company, 42 Broadway, New York City; Richard H. Brown, president, Manhattan Electrical Supply Company, 17 Park Place, New York City; Robert E. Dwyer, vice-president, Anaconda Copper Mining Company, 42 Broadway, New York City; Henry L. Wardner, treasurer, New Jersey Zinc Company, 160 Front St., New York City; W. C. Siderfin, vice-president, Clark Montana Realty Company, Butte, Mont.

Publicity Committee — H. A. Pumpelly, chairman, vice-president, Domestic Manganese Development Company, Owego, N. Y.; John Hickey, president, Moorlight Mining Company, Philipsburg, Mont.; F. N. Hicks, Chicago, Milwaukee & St. Paul Railway, Seattle, Wash.; C. G. Ewing, president, Philipsburg Mining Company, St. Louis, Mo.

Traffic Committee—Charles W. Massie, chairman, secretary-treasurer, Hy-Grade Manganese Company, Woodstock, Va.; E. F. Rummel, Chicago, Milwaukee & St. Paul Railway, Butte, Mont.; N. H. Mannakee, Box 862, Bluefield, W. Va.; W. G. Rinehart, Batesville, Ark.; H. O. Flickinger, president, Silver Prince Mining Company, Philipsburg, Mont.

Geological Committee—Dr. J. S. Grasty, chairman, Charlottesville, Va.; Carl Zapffe, Northern Pacific Railway Company, Brainerd, Minn.; Reno H. Sales, chief geologist, Anaconda Copper Mining Company, Butte, Mont.

Ore Strikes Made at Several Arizona Properties

Magma Copper Company Finds New Deposit—C. & A. Uncovers Rich Lead Ore at Hiltano Property

A NEW high-grade orebody has been found at the 2,150 level of the No. 5 shaft of the Magma Copper Company in Superior. Some of the deposit is peacock ore, or bornite, carrying silver and gold, as well as copper. The ore is found in cross-fractures in dipping limestone strata. In the older workings at the property, which are at a depth of 2,800 ft., a large lens of zinc-lead ore of excellent quality has been disclosed. This is being reserved for future operations.

Development work at the Hiltano property, east of Tucson, now under bond to the Calumet & Arizona Mining Company, is reported to have uncovered a considerable quantity of high-grade lead ore below old workings. This is a deposit in limestone, and the ore occurs in caves and replacements along fracture zones. Smaller deposits of high-grade ore have been found near the surface in former operations, but the present company plans to prove whether high-grade ore is also to be found at depth.

A new vein of ore, believed to be a stringer from the famous Vulture lode, which was lost in a slip at a depth of 500 ft., is reported to have been found on the Hermosa group of claims, twelve miles west of Wickenburg. Just 4 ft. below the surface, facing a hanging wall of schist, miners, while doing location work, struck a 20-in. vein of ore. A body of galena ore, 2 ft. wide, is also reported to have been encountered at the Black Hawk claim in the Vulture mining district.

During the past two years, the Shattuck-Denn Mining Company has carried on an intensive development campaign. In connection with the Calumet & Arizona Mining Company, it diamond-drilled claims in the vicinity of the town of Lowell and also did considerable underground exploratory work on the 1,400, 1,600, and 1,800 levels. On the 1,800 level, two small orebodies were encountered. The first one was partly carbonate and partly sulphide ore, and was followed down for about 140 ft. on an incline. The second was mostly chalcocite and was surrounded by a large area of siliceous material, carrying low-grade copper values. According to report, the first orebody was close to the Junction side lines, with the second approximately 150 ft. away. This second orebody has been stoped on the 1,800 level for about six sets in width and ten sets in length, and a winze has been put down in it for a distance of about 35 ft. All of this mined ore has been of good grade and has paid operating expenses while the main hoisting shaft was being sunk to the 2,000 level. Since the main shaft pierced the Dividend fault it has been in much heavy, wet ground. Besides the regular shaft timbers, jacket sets, 3 ft. back of the regular timbers, had to be put in so that continuous hoisting might be assured and several sections which contained excessive moisture might be drained. Sinking was completed and cages were put in operation about Oct. 1. Drifting was immediately started to explore the territory immediately under the 1,800 orebody. A drift of approximately 500 ft. in length is planned, although it is possible that this length is excessive, as the ore may dip closer to the shaft on this lower level.

Drifting is on contract and is progressing at the rate of 8 ft. a day, the total length completed to date being approximately 200 ft. from the shaft. Mineralized ground is being entered, and it is reported that a small amount of ore has already been struck. The mine officials have stated that they expect to be directly under the larger mineralized area on the 1,800 level within 30 days. This mineralized area, which is 300 ft. x 300 ft., is thought to be a large-sized capping over an orebody. In the Bisbee district, good orebodies under mineralized cappings are the rule. In this district, approximately 70 per cent of the orebodies already found have had similar cappings, according to the statements of geologists in the district. This new ore find is all in the old Denn property, which was consolidated several years ago with the Shattuck holdings. In its relation to surface, the new ore lies between the general manager's residence and the city cemetery, and about one-quarter of a mile from the large Campbell orebody of the Calumet & Arizona Mining Company. A small strike of rich copper ore has also been made in the old Shattuck holdings, up the hill from the Southwest division of the Copper Queen.

THE crosscut from the 500-ft. level of the Lucky Boy shaft, which is being driven by the United Verde Copper Company to strike the vein on the Oatman Eureka property, recently optioned by this company in the Oatman district, is now in 450 ft. and is advancing at the rate of 8 ft. a day. At one point a stringer of good ore was cut, which is believed to be evidence that when the large vein is reached important ore-bodies will be found. The vein the United Verde is planning to prospect is a parallel vein to the main Tom Reed vein of the district. This is the first prospecting on a large scale that has been undertaken in its neighborhood.

The Sunnyside Mining Company, some distance to the east of the Oatman Eureka, is driving to cut the vein indicated by the high-grade stringer encountered in the United Verde's crosscut. This vein is believed to carry good ore at the point of contact, and the Sunnyside organization expects to cut it within the next 30 to 40 days.

The work on the new shaft for the Tom Reed and Gold Ore companies is well under way, with three shifts operating. When completed, this shaft will be close to the Aztec oreshoot.

Important Copper Camp Probable in Kotsina Valley

May Construct Smelter at Ketchikan—Galena Deposit Discovered in Haley Mine at Silver Bay

KOTSINA VALLEY, Alaska, may become an important copper camp. More than a thousand claims are located in that area, but development is handicapped for want of transportation. It costs about $100 a ton to get in supplies under existing conditions. Yet owners of claims maintain their assessments. One company plans development involving an expenditure of $2,000,000, and is putting ore on the dump awaiting the time when road construction will permit shipments to be made.

A move is on foot at Ketchikan to establish a smelter there for the treatment of the ores of Portland Canal and Alaska. About 25 years ago the Alaska Smelting & Refining Company operated a smelter at Hadley in connection with a copper mine at Maple Bay, Portland Canal, but the venture was not a success financially. The Baranof Mining Company, of Sitka, is developing the old Haley mine, at Silver Bay. The ore is a gold quartz, similar to that of the Chichagoff Island mines. A galena deposit, also carrying gold, was recently discovered on the property, which was recently examined by Dean Charles E. Newton, of the School of Mines of the University of Oregon. The mine is now controlled by E. P. Preble, of Portland, who plans to begin extensive operations at the property next year.

The Inspiration Joint Mining Company, of Skagway, has financed the construction of a tramway to deliver the silver-lead ore from its mine to the White Pass and Yukon Railway. Mineral resources of the Wrangell Mountain region are attracting increasing attention. The great drawback of the district is its lack of transportation, but this difficulty will be overcome when the Alaska Road Commission completes the road it has under construction from Gulkana. Gold production of the upper Tanana will not exceed $12,000 for last season, owing to the shortage of water. The Orange Hill copper property on the Nabesna proved up well under diamond drilling. A new silver-lead strike on Indiana Creek is traceable for a length of a mile and a half; the vein is from 6 to 8 ft. in width.

The Porcupine Gold Mining Company, which owns placer and gold-quartz claims on Porcupine Creek, within Alaska and west of Rainy Hollow, claims to have opened up a quartz vein over a length of three miles. The company's placer property is equipped with a hydraulic plant, which was operated last summer. The company is controlled by J. Stenbraten, of Haines, and W. Bunting, of Hyder.

A strike of rich gold-quartz is reported from Golconda Creek, Copper River. The vein has been prospected for a length of 3,000 ft. and shows free gold over the entire distance.

South view of Cardiff overthrust; Alta Merger properties and Louise mine in foreground

New Orebody Found Along Cardiff Overthrust Contact

Interest in Exploration Stimulated by Discovery— Thickness of Deposit Reaches Twenty Feet —Length Not Yet Determined

INTEREST in exploration of the Cardiff overthrust contact at Alta, Utah, 30 miles southeast of Salt Lake City, has been stimulated recently by the opening in the Cardiff mine of a body of carbonate lead-silver ore that has been crosscut for 50 ft. and in one place shows a thickness of 20 ft. The length of the orebody has not been determined, as the deposit has hardly been more than holed into. The new shoot is about 800 ft. north of the one found in 1914, which was productive of $12,000,000 in ore and $1,050,000 in dividends.

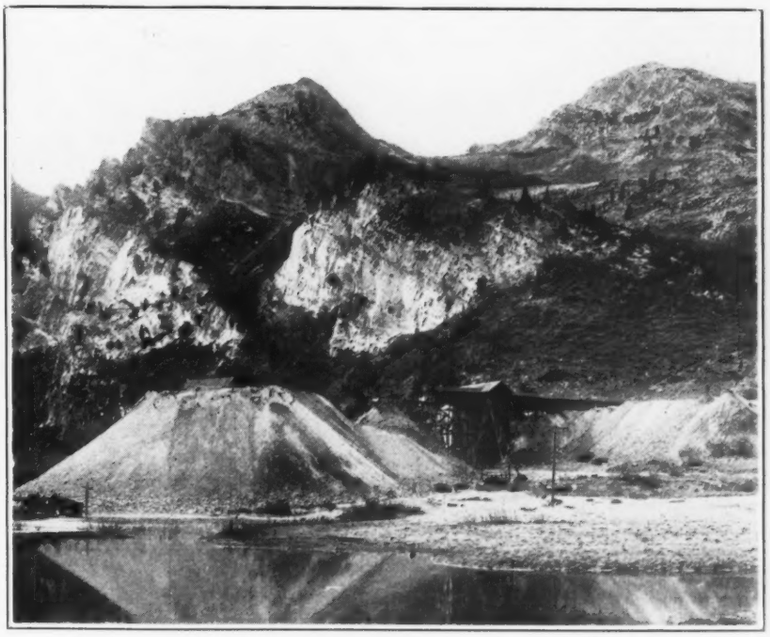
The Cardiff overthrust contact, perhaps one of the most striking examples of its type in the world, has been formed by the riding of the Cambrian quartzite over the Carboniferous limestone. Two north-south faults have thrown the overthrust up to the west and down to the east. On the west limb, the overthrust has been entirely eroded. On the Cardiff property, the overthrust does not outcrop, since it has been displaced downward. In this geologic column, the Devonian, Silurian, and the Ordovician are apparently absent.

The orebodies associated with the overthrust contact occur as a replacement of the limestone where intersected with northeast fissures. The overthrust quartzite forms the hanging wall, and the underthrust limestone the footwall. Dip of the contact varies from 22 to 25 deg. to the east, and the strike is north 20 deg. west.

In places, the Cambrian shale has been included as drag on the overthrust. In the Columbus Rexall mine, adjoining the Cardiff to the south, in one section in the lower branch, the upper and middle Cambrian quartzite are in contact with the underlying Carboniferous limestone. In the upper branch, the overthrust quartzite is brought into contact with the post-Cambrian limestone and the Cambrian shale, and for short distances with limestone believed to be Cambrian, lying just above the Cambrian shale.

In the old Columbus Extension mine, ore is found in the upper branch, where it is crossed by northeast fissures and where limestone forms the footwall of the fault. In the Rexall area, the ore was found where the Cambrian shale pinched out; here the quartzite lies directly on the Carbonifierous limestone.

About a mile and a half in an air line from the Cardiff mine, the Louise Mining Company is developing the southern extremity of the Cardiff overthrust. Practically the same conditions prevail in this property as in the Cardiff. Extensive mineralized sections have been opened up in numerous workings. At present, the company is raising on a shoot of high-grade zinc-lead-silver ore to the contact, where it is believed a bedded deposit will be encountered.



The Columbus Rexall mine along the overthrust

C. & A. to Sink Another Shaft at Eighty-five Mine

A new shaft will be sunk in Calumet & Arizona's Eighty-five mine, at Lordsburg, N. M. This property was purchased principally to supply siliceous ores that were needed in the operation of the company's copper smelter at Douglas, Ariz., such ores being scarce in the Southwestern mining fields. The mine not only has been supplying an ample tonnage of silica, but development has proved that it also contains important amounts of copper and precious metals.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Volume of Shares Traded on Standard Mining Exchange Establishes New Record

TORONTO, Nov. 19—If the Canadian mining market continues its present pace the New York Stock Exchange will have to look to its laurels. Trading in November on the Standard Mining Exchange of Toronto has amounted to about 2,000,000 shares a day. On Nov. 14 3,686,386 shares were traded in, and on the following day more than 3,500,000 shares; brokers are talking of the possibility of 4,000,000 share days before the end of the year. Such a volume of trading has never before been seen on Canadian exchanges, and it is doubtful if it has ever been paralleled in American mining history. It is, however, noteworthy that speculation was confined almost entirely to the speculative issues, and that the established proven mines were practically lost sight of in the excitement. The value of the securities traded in for the first nine months of the present year is 50 per cent greater than that for the twelve months of 1926 and 350 per cent greater than that for 1925. Frenzied speculation such as this, a very large part of which has little relation to mine values, carries its own warning, and many of these cheap stocks may soon be expected to drop back where they belong.

THE Flin Flon situation continues to be of interest, and a statement issued by the Hon. John Bracken, Premier of Manitoba, indicates an early settlement of the railway problem which is understood to be the one uncertain factor holding up negotiations. Mr. Bracken states that the Manitoba government has reached a decision by which it is expected that an agreement with the dominion government and the Canadian National Railway will be completed, insuring the construction of a railway line 85 miles long, to serve the section of the Province north of The Pas. Under this arrangement the government, instead of guaranteeing the bonds of a railway, will make payments not exceeding $100,000 a year for a period of five years, if there should be any operating deficits during the development period through which the territory must pass. The Whitney interests will contribute $250,000 toward the railway in order that arrangements may be made to complete the line without delay. They will also undertake to build and operate a plant at Flin Flon capable of handling 3,000 tons of ore a day and will develop a hydro-electric power plant which will have an ultimate capacity of 270,000 horsepower. It is estimated that total expeditures, including the railway, will be about $18,000,000. The value of the ore reserves of the Flin Flon are placed at $200,000,000, and it is expected that the Sheritt-Gordon will soon be able to show $100,000,000 of reserves. The dominion government was not at first in favor of the proposal of a guarantee of $100,000 a year for five years to meet operating deficits, but eventually decided to accept it if offered. The matter has now been laid before the Manitoba government and has received the unanimous approval of the House. The Mining Corporation, which is the vendor, will retain a 15 per cent interest in the property, and will also receive cash or bonds to cover the disbursements which the company has already made.

The first two of the brokers to be sentenced in connection with the raids made by the Attorney-General's Department of Ontario in connection with the Worthington Company case were H. W. Fields and N. Gilbert, each of whom was sentenced to two years in the penitentiary. The Attorney-General's Department has also decided to appeal the sentence of W. P. Wilson, who pleaded guilty of high-grading. Wilson handled approximately $160,000 worth of stolen gold and received a fine of only $1,500. The government has decided that an example must be made of some of these cases, which have been treated altogether too lightly.

At the Noranda mine, in Rouyn, a start has been made on sinking the main shaft from the 550 level to the 1,000. Stations will be cut at 100-ft. intervals. The first 500-ton unit of the smelter is practically completed, and furnaces, converters and roasters are now being dried out in preparation for starting operations by Dec. 15. The present unit has a capacity of 500 tons a day. Meantime, the second 500-ton unit is being completed. Construction of the 500-ton concentrator has been started.

Present indications are that the Frood Extension mine, owned by the Mond Nickel Company, may develop into as important a property as the adjoining Frood mine of the International Nickel Company. The deepest development on the Mond property is at 2,000 ft., but deep diamond drilling is being carried on, one hole showing a horizontal width of 70 ft. copper-nickel ore at a point a little below the 3,000 level. The International Nickel Frood shaft is down 2,200 ft. and will be continued to 3,000 ft., at which point, 1,200 ft. of cross-cutting will be necessary to intercept the high-grade copper ore. By 1930 the International Nickel Company should be in a position to turn out more than 100,000,000 lb. of copper annually, and, with the rich ore being shown by the drills at the Frood Extension property, this amount of copper from the Sudbury district should be substantially increased.

At the Kirkland Lake Gold property the crosscut has intercepted the vein at 2,600 ft.; the vein shows good values across a width of 8 ft. This is the deepest work in the Kirkland camp.

London Letter

BY W. A. DOMAN
Special Correspondent

Tin Makes Partial Recovery —Hopeful Feeling Grows as Shares Advance

LONDON, Nov. 15—Tin, which has been weak for a considerable time, has made a partial recovery, the price being now £264 per ton. The rally has had its effect upon mining shares, and a more hopeful feeling prevails. The project to stabilize the price and control the output remains unchanged, though naturally the people behind it have not abandoned their standpoint. There seem to be difficulties which they had not taken into consideration, such as the long forward contracts entered into between the smelting companies and some of the producers. It is pointed out, as a curious fact, that two or three companies that are in favor of control have placed orders for something like fifteen additional dredges, the majority of them being of greater capacity than those at present in operation. If output is to be controlled, this new equipment must mean that an attempt will be made to work at a lower level of costs.

The condition of Bwana M'Kubwa is still causing shareholders a good deal of disappointment. As has been previously mentioned, the plant has been blamed for inefficiency on the one hand, and on the other it was said that the ore reserves were insufficient. Whatever may be the real reason, substantial blocks of shares have been disposed of by holding companies, whose directors apparently are aware of recent developments at the property.

THE Panama Corporation is bringing out its first subsidiary under the title of Panama No. 1, Ltd. Its nominal capital is £180,000, and the property to be taken over is El Remance mines, situated in the Province of Veraguas. V. F. Stanley Low, who has reported favorably upon it, says that to bring the mine into commercial production will require £80,000. The public is being given an opportunity to speculate in the shares, for there is to be an immediate issue at par of 60,000 10 per cent preference shares of £1 each, and 1,080,000 deferred shares of 1s. each. Of the deferred shares, 960,000 are to go to Panama Corporation as part payment of the purchase price. If the results of development justify the provision of machinery and equipment, a further issue of shares will be made.

According to Sir Frederick Mills, the chairman, the Chemical & Metallurgical Corporation is making great strides. Its patents cover a process for the separation of zinc and lead, so that a zinc-lead concentrate can be dealt with by hydrometallurgy, the resultant product being a lead residue free of all zinc, and a zinc residue free of all lead.

Mexico City Letter

By W. L. Vail
Special Correspondent

Government Figures Show Few of the Important Properties Closed

Mexico City, Nov. 16—According tc statistics recently announced by the Mexican Department of Commerce, Industry and Labor there were only 26 mine shutdowns of importance between August, 1926, and July, 1927. Of this number, eleven resulted from the exhaustion of workable orebodies. Among these were the property of the El Oro Mining & Refining Company; the Esperanza, of El Oro; La Blanca, Pachuca; La Luz and Angustias, of Guanajato; Consolidacion Mineral of Parral; and a property at Sombrette, Zacatecas. Two properties have closed because of the low price of silver, and nine because of the depreciation in the price of zinc or lead. About 4,700 workmen were thrown out of employment. This situation, together with the steady reduction of the working forces in most of the larger properties, is creating a problem for the authorities. The statement claims that there have been no suspensions on account of strikes—the incidents at the Amparo mines probably have been forgotten. A recapitulation of mineral production from the year 1910 is furnished the press, evidently for the purpose of substantiating the claims of the government that the mining situation is excellent, and that, if it is not, the fault must not be laid to the present mining legislation of the department, which is thought by many mine operators and would-be investors to be prejudicial. The big falling off in gold production is charged to the closing of the camps at El Oro and Tlalpujahua, which for years were the big gold-producing centers of the republic. Under present economic conditions there is no immediate prospect of the opening up of new gold fields by outside capital.

Enrique Najera, the present governor of the State of Durango, is reported making arrangements to reopen a number of abandoned properties at Topia, Durango. Some of these mines were worked as long ago as 1656 and are supposed to be capable of profitable production under modern operating methods. As a part of the plan to revive the Topia properties, the state government is prepared to subsidize a railway project from the city of Durango to Topia, and an extension to Culiacan, in the State of Sinaloa.

Reports from Parral announce the taking over of Iguana and Eureka properties from M. E. McDonald by the American Smelting & Refining Company. These mines adjoin the smelting company's Prieta unit. They were held under option for some time by Real del Monte interests and turned back after an exhaustive examination. The San Francisco del Oro mines are operating on the same schedule as during the last year. No political disturbances have been reported.

Development on the Pilar mine, near Copalitas, State of Sinaloa, is being rapidly pushed, according to a statement of the superintendent, who writes that there is enough high-grade ore blocked out to keep the new 100-ton mill operating for a long time. Recent experimental milling tests made on ore sent to Los Angeles were reported to have been quite satisfactory. The mill will probably be in operation early next year.

The Socavon de San Fernando interests, Zacualpam, State of Mexico, recently voted an increase of stock for the purpose of modernizing the plant, and found no trouble in placing the new issue among their own stockholders. Improvements at the company's property will be started at once.

Extension of one of the large plants at Monterey is planned to take care of the refining of metals that are now being sent abroad for treatment. Work will be started as soon as the federal department approves of the plans. The expenditure involved is expected to exceed 3,000,000 pesos.

Owners of contracts on the Mother Lode in Guanajato have already gone down 500 ft. with diamond drills and profess to feel confident of striking the orebody. The contractors have recently installed larger air compressors and are endeavoring to speed up the work.

It is stated that the Peñoles company has cancelled its working contract on the Conejo Blanco and Conejo Colorado mines in the State of Oaxaca. Local officials refuse detailed information, and the exact cause for abandonment of the contract is not generally known.

The El Oro Mining & Railway Company, of El Oro, State of Mexico, has been ordered by the supreme court to pay into the municipal treasury of the city of El Oro the sum of 17,902 pesos and five centavos, representing alleged back taxes.

The Republican Mining & Milling Company is smelting antimony at Wadley, San Luis Potosi. It is reported that the American Metals Company is examining some alleged tin prospects in the State of Zacatecas.

Ore production at the Santa Margarita mines, Pachuca, for September is officially announced as 23,000 tons. Ore values in the San Luis vein, it is reported, continue to increase materially.

The proposed bill for federalizing the labor laws, with amendments to the present constitution, continues to hang fire in the Senate, without any immediate possibility of reaching a vote.

Reports, appearing in the local papers stating that the plant of the Afinadora y Refinadora, of Monterey, is to be shut down are emphatically denied by the management.

Johannesburg Letter

By John Watson
Special Correspondent

Transvaal Chamber of Mines Announces Gold Output During September

Johannesburg, Oct. 18—The output of Transvaal gold for September was declared by the Chamber of Mines on Oct. 10 as 842,118 oz., equal in value to £3,577,090. Compared with the August production, which was a record, these figures show a decrease of 21,227 oz., having a value of £90,166. It must be borne in mind, however, that September had one working day less than August, which more than accounts for the decrease. Also, many of the miners could employ many more natives than are now available. The native labor returns show 186,413 "boys" working on the Rand gold mines on Sept. 30, an increase of 2,034 compared with Aug. 31.

A Pretoria syndicate has been doing prospecting work on the farm Rietfontein No. 69, in the Krugersdorp district, where a banket reef is now exposed for about 175 yd. The discovery was made last June. In August, the directors, accompanied by Dr. Hall, of the Geological Survey, visited the property. Samples taken by the Inspector of Mines and assayed in the government laboratory show: 24.5 dwt. over 36 in. width; 28 dwt. over a reef 7 in. wide; 5 dwt. over 7 in. and 2 dwt. over a reef 8 in. wide. Dr. Schlesinger has been appointed consulting mining engineer of the syndicate, and Peter Macadam, Jr., geologist, has prepared a preliminary report on the syndicate's holdings.

The August mineral output from Rhodesia was recently declared as follows: Southern Rhodesia, total value £336,894, a decrease of £44,079 compared with July. Gold output totaled 47,297.85 oz., equal in value to £199,860; the silver production amounted to 11,389 oz., valued at £1,283; coal, £36,933; chrome ore, 16,922 tons, £39,811; asbestos, 3,006 tons, £56,012; tin, 5.17 tons, £1,321; tantalum (adjustment December, 1926), £11; mica, 31,728 lb., £1,490; diamonds, 30.75 carats, £173. For Northern Rhodesia, the total mineral value for August was £25,858, including copper, 344 tons, £13,758; lead, 500 tons, £11,664; mica worth £56, and manganese valued at £106.

Onverwacht Platinum, Ltd., reports that, during September, 2,370 tons of ore was milled, giving an estimated yield of 567 oz. of platinum group metals, equivalent to 4.8 dwt. per ton milled. The exploratory work on the 500 level exposed an area of 269 sq.ft. averaging 3.1 dwt.

The British India steamer "Khandalla," which left Durban on Oct. 10 for the Far East, carried £57,000 in gold and specie, in a specially constructed safety hold.

Societies, Addresses, Reports

A.I.M.E. Organizing Trip to Venezuela in February

AN UNUSUAL opportunity to combine business with pleasure is offered in the Venezuela trip being organized by the American Institute of Mining and Metallurgical Engineers for the first three weeks of February. A large and comfortable vessel will be secured if a sufficient number of applications are received; stops will be made at Havana, Kingston, and at the Panama Canal; and a five-day trip through the Venezuela oil fields arranged, with an alternative side-trip to La Guayra, Caracas, and Puerto Cabello. The opportunity to inspect the new and important petroleum operations in Venezuela under proper guidance and at moderate cost is unique, and for those not particularly interested in petroleum, the cruise offers a short winter vacation in a warmer clime with congenial companions.

If 175 definite reservations are secured before Jan. 1, the "Lapland," of British registry, with accompanying conveniences, can be chartered. The ship will leave New York on Jan. 31. A stop will be made at Havana, where a shore trip will be arranged; at Kingston, where a half day will be allowed for a drive about the island; and at the Canal Zone, where a train will convey the party to the Pacific side. Launches will be provided for a water trip through the Gaillard Cut, Gold Hill, and the Cucuracha Slide, and in the afternoon the sightseers will drive through old Panama City, returning to Cristobal by a special train.

Arriving at Curacao on Feb. 10, the party will divide, provision being made for a maximum of sixty on the steamer "Maracaibo," visiting the oil fields around Lake Maracaibo. This ship will leave Curacao at 4 p.m., touching at Maracaibo City on Feb. 11, at San Lorenzo and Mene Grande on Feb. 12, at Lagunillas and Cabimas on Feb. 13, and arriving at Paraguana on Feb. 14, where the party will re-embark on the "Lapland."

In the meantime, the other party will visit La Guayra, enjoy a drive over the new concrete road through picturesque mountain scenery to Caracas, where special entertainment will be provided, and also stop off at Puerto Cabello. The entire party will then return directly to New York, with arrival scheduled for Feb. 20, in time for the Institute smoker that evening and the annual meeting.

Among those who, with various members of their family accompanying them have made tentative reservations, are the following:

George D. Barron, W. H. Bassett, Carl Brewer, Henry Robinson Buck, B. M. Concklin, Eli T. Conner, H. A. Coy, Alvan L. Davis, Sidney H. Davis, E. DeGolyer, H. Denman, Samuel Dixon, R. L. Dudley, J. W. Feagin, V. R. Garfias, F. Taylor Gause, J. S. Grasty, Martin L. Griffin, Dr. W. R. Jillson, William Kelly, R. W. Mueller, T. T. Read, J. V. W. Reynders, Robert H. Richards, R. F. Ryan, Arthur Simon, George R. Simpson, Philip S. Smith, V. C. Smith, Irvine E. Stewart, Albert L. Stillman, George C. Stone, S. A. Taylor, William Huff Wagner, O. W. Wells, Benjamin F. Welton, H. N. Witt.

The rates for each person are $250 up, with lots of rooms at $300 and $350, and rooms with private baths at $750. Small extra charges will be paid for side trips, an allowance of $50 being considered sufficient for all such expenses. The Maracaibo trip will be $30.

Those who wish to make tentative reservations for the trip, whether members of the Institute or not, are urged to write immediately to the Secretary of the A.I.M.E., 29 West 39th St., New York City, for full particulars.

Lectures on Geophysics Given at McGill University

McGill University, Montreal, has added to its curriculum a course of lectures in applied geophysics. The lecturers are Dr. A. S. Eve, Macdonald professor of physics at McGill University; Dr. D. A. Keys, associate professor; and Dr. E. S. Bieler, assistant professor. All of the lecturers were engaged in practical geophysical work last summer, Dr. Bieler working in the Rouyn area of northwestern Quebec, and Drs. Eve and Keys at Caribou, Colo.

Commenting on the importance of applied geophysics in mining today, Prof. Wilbert G. McBride, Macdonald professor of mining engineering at McGill University, recently said:

"So far, in metal mining, the work of the geophysicist has been largely experimental. Some of the experiments have been successful in locating orebodies, and others have been failures, but it would seem that with a greater knowledge on the part of the operators of the geophysical apparatus, and on the part of mining men, geophysical methods will ultimately play a very important part in prospecting for orebodies in undeveloped fields and in finding extensions to old fields.

"Electrical and magnetic methods seem to offer the greatest possibilities. In mines which are operating, the presence of electrical wires, pipe lines, and tracks underground has interfered with obtaining satisfactory results, but it is hoped that with further knowledge of the subject this interference will be overcome. I think the methods are particularly important for prospecting geologically favorable areas in the unexplored regions of Canada, where forests, muskeg, and lakes mask the surface outcrops of orebodies to a very large extent. Geophysical methods, however, must be handled with great care, and only in conjunction with geological work. Areas prospected by the geophysicist should subsequently be prospected by diamond drilling and other methods for the definite determination of the nature of the rock or orebody. In other words, geophysical methods should be used only as an aid to geology in determining the most favorable places in which to do actual development. If intelligently used they should aid very materially in the development of the large areas of promising territory in northern Canada.

"In Canada, and elsewhere, some of the alleged failures which have been charged against geophysical methods have been failures only on account of the ignorance of those making the charge. Zinc sulphide gives no reaction to either electrical or magnetic methods, and, consequently, so far, it has been impossible to use these methods to find zinc deposits. In spite of this fact, the failure to find zinc orebodies has been used to condemn the methods.

"At present it is impossible to evaluate these methods accurately as applied to metal deposits, but it seems quite likely that as the methods are improved metal mining will ultimately be greatly benefited by intelligent geophysical prospecting."

Michigan College Announces Enrollment Statistics

Although the curriculum of the Michigan College of Mining and Technology, at Houghton, has been enlarged to include other branches of engineering, more than 50 per cent of the new students enrolled this fall elected to take courses in mining and metallurgical engineering. Out of a total enrollment of 134 new students—the largest freshman class in the history of the institution—69 registered for courses in mining and metallurgy and 65 in the other branches of engineering.

Fewer than half of the graduates of the institution are engaged in mining or kindred industries, according to a compilation of statistics taken from cards returned by former students at the time of the publication of the last alumni directory. The records of the Alumni association show that 58.5 per cent of 1,241 graduates are successfully engaged in occupations other than mining and geology.

U. S. Civil Service to Hold Examinations

The U. S. Civil Service Commission announces open competitive examinations for the positions of engineer, associate engineer, and assistant engineer. Applications for these examinations must be on file not later than Dec. 13. Full information concerning the examinations may be obtained from the U. S. Civil Service Commission, Washington, D. C.

Recent Technical Publications

Scientific Processing

PRINCIPLES OF CHEMICAL ENGINEERING. By W. H. Walker, W. K. Lewis, and W. H. McAdams. Second edition. McGraw-Hill Book Co., New York; 770 pages. Price $5.50.

THE rapid advance in chemical engineering is indicated by the developments in theory and practice that have necessitated a second edition of this treatise in four years. The original volume stressed the scientific principles on which chemical engineering operations are based. From these principles were developed, in orderly sequence, the methods of utilization in the practical solution of industrial problems. The first edition dealt with stoichiometry; the laws governing the flow of heat and the flow of fluids; the efficient combustion and economical utilization of fuels; the theory and practice of crushing, grinding, classification, and filtration; vaporization, from the vapor pressure equilibrium standpoint; drying and water cooling, evaporation, and distillation.

The second edition, now published, evidences continued scientific and technical progress in this field; theory and practice in diffusion work, including gas scrubbing, percolation, filtration, and lixiviation, is given attention. The authors and publishers are to be commended for their efforts to bring so important a treatise abreast of the times and without undue delay.

—A. W. ALLEN.

Higher Mathematics

EXPONENTIALS MADE EASY. By M. E. J. Gheury de Bray. Macmillan and Company, London and New York.

"EXPONENTIALS MADE EASY" is intended by the author to form a companion volume to "Calculus Made Easy," a little book which many will remember gratefully as having smoothed oue of the most difficult portions of their ascent to the mathematical Parnassus. This little book on Exponentials is an admirable achievement, and the author is to be congratulated on having clarified the whole subject. Beginning with the simplest exponential expressions, the book takes the reader through the Binomial Theorem to the consideration of logarithmic spirals, the catenary, and the probability curve. In doing so, the hyperbola and parabola are fully discussed. The concluding chapters are devoted to analysis and resolution of exponential curves of the type $y = A_1\varepsilon^{\alpha_1 x} + A_2\varepsilon^{\alpha_2 x}$ by J. W. T. Walsh's method. After a careful study of these chapters the reader has the satisfaction of feeling that he had made the acquaintance of a branch of higher mathematics to which, like the reviewer, he may never have expected to attain. This book will be of great value to engineering students and to engineers whose work suddenly calls for the utilization of a branch of higher mathematics their knowledge of which may have become rusty and require refurbishing. E. G. LAWFORD.

CANADIAN MINING HANDBOOK—The second volume of "The Financial Post Survey of Mines in Canada and Newfoundland" is now available. This is not only a directory of practically all the mining companies in the dominion, with the names of officials, financial data, properties owned, and scope of operations, but contains a large amount of general statistical data and information regarding natural resources. Both metal and non-metallic mines are covered. The price, $1, is exceedingly reasonable considering the information given. It may be obtained from *The Financial Post*, 143 University Ave., Toronto, 2, Canada.

GUIDE PRATIQUE DE LA PROSPECTION DES MINES ET DE LEUR MISE EN VALEUR. Fourth edition, revised and enlarged. By Maurice Lecomte-Denis. Published by Dunod, 92, Rue Bonaparte, (VI), Paris, France. Price, unbound, 100 fr.; bound, 111 fr.

This is a new edition of a well-known French text, containing a large amount of material valuable for prospectors and exploiters of mineral deposits. A valuable section of the book is devoted to the selling and financing of prospects.

EXPLOSIVES—A German treatise on explosives, their chemistry and manufacture, has recently been published as Vol. 16 of the "Technische Fortscrittsberichte." The current treatise entitled "Schiess-und Sprengstoffe," is a book of 200 pages by Dr. Ph. Naoum, and is published unbound at 12.50 Reichsmarks, or bound at RM. 14, by Thoedor Steinkopff, Residenzstrasse 32, Dresden-Blasewitz, Germany.

Another book, just published in the United States, is a weighty tome of 1,152 pages on the same subject, the "History of the Explosives Industry in America," by A. P. Van Gelder and Hugo Schlatter. This is published by the Columbia University Press, New York City, under the auspices of the Institute of Makers of Explosives, and sells for $10.

ARSENIC ORES—The Geological Survey of Canada, in its publication of the paper entitled "Arsenic Bearing Deposits in Canada," by Dr. M. E. Hurst, has added a fourth volume to its set of reports designated as "Economic Geology Series." The report presents detailed descriptions of the known deposits and is illustrated by maps and diagrams.

THE RAND—A study of the identity of reefs in the Far East Rand is made in an article entitled "A Great Economic Problem," by J. S. Olver, which appears in the Oct. 8 and 15 issues of the *South African Mining and Engineering Journal.*

BELGIAN CONGO—*Commerce Reports* for Nov. 21, 1927, contains a short review of the mining developments in the Belgian Congo, which has been abstracted from consular reports.

CHILEAN NITRATE—A three page review of the Chilean nitrate situation is given in *Commerce Reports* for Nov. 21, 1927. It is, in the main, an abstract of the annual message of the president of the Chilean Nitrate Producers' Association, delivered on Sept. 29 last. Conditions which have affected the sales of nitrates in recent years are set forth and the need for a substantial reduction in export taxes, if Chile is to retain a fair share of the oversea market, is urged.

PATENTS

METALLURGICAL METHOD. No. 1,648,954. Nov. 15, 1927. John Wesley Marden, assignor to Westinghouse Lamp Company.

A method of producing rare metals and their alloys, which consists in reducing a salt of the rare metal with a second metal and later volatilizing the second metal in an inert environment.

PULVERIZING FUEL. Nos. 1,649,147 and 1,649,148. Nov. 15, 1927. Charles E. Blyth. Assignor to Alfred Herbert Limited, Coventry, England.

A machine for pulverizing fuel by rotating impact members, the pulverized product being removed by air separation when fine enough.

METALLURGICAL METHOD. No. 1,649,152. Nov. 15, 1927. Louis F. Clark, Potrerillos, Chile.

A method of oxidizing metallic solutions to remove metallic impurities, the method comprising the injection of an oxident and nitric oxide.

COMPRESSOR. Nos. 1,649,297; also 1,649,298 and 1,649,299. Issued respectively to Sven T. Nelson, Frank A. Halleck, and Alexander B. Ferguson, all assignors to Sullivan Machinery Company, Chicago.

Details of compressors design. The third patent treats the compressor as a pumping unit.

MINE CAR. Nos. 1,649,395 and 1,649,396. Nov. 15, 1927. Henry P. Field, Berwick, Pa., assignor to American Car & Foundry Company, New York.

Details for mine car design.

MINE CAR. No. 1,649,433. Nov. 15, 1927. Victor Willoughby, Ridgewood, New Jersey, assignor to American Car & Foundry Company, New York.

Details of the mechanism of a hopper car door.

CRUSHER. No. 1,649,565. Nov. 15, 1927. George W. Borton, New Lisbon, and William A. Battey, Haverford, Pa., assignors to Pennsylvania Crusher Company, New York.

Details of design of a grinding machine of the hammer mill type.

Personal Notes

CHARLES A. MITKE is in Colorado on professional business.

IRA B. JORALEMON, of San Francisco, has returned from Quebec, stopping en route at New York.

WILBUR H. GRANT, of San Francisco, has returned after a month's professional work in British Columbia.

RALPH H. NOWLAND and AUGUSTUS LOCKE, of San Francisco, have been examining properties in Arizona.

G. A. JOSLIN, of Los Angeles, has gone to Mexico. He expected to return to Los Angeles about December first.

RAYMOND BROOKS' New York office is at 26 Beaver St., instead of 27 Beaver St., as stated in the issue of Nov. 26.

G. C. PIDGEON, chief engineer for the Copper Queen branch of the Phelps Dodge Corporation, is visiting the mines at Ely, Nev.

GLENVILLE ARTHUR COLLINS, consulting engineer, announces the opening of offices at rooms 704 and 705 Hollingsworth Building, Los Angeles.

PHILIP D. WILSON, mining engineer and geologist with the American Metal Company, has returned to New York from a professional trip to Cuba.

CLINTON H. CRANE, president of the St. Joseph Lead Company, has been elected a member of the board of directors of the Phelps Dodge Corporation.

HENRY S. MACKAY left Cloncurry, Queensland, late in October and may be reached through HENRY S. MACKAY, JR., 746 Title Insurance Building, Los Angeles, Calif.

Dr. J. H. CURLE, who has been touring Rhodesia, has now returned to Johannesburg, He was greatly impressed with the potentialities of the Cam & Motor and Sherwood Starr mines.

A. A. MACKAY, of the mining engineering firm of Anderson, MacKay & Armstrong, Montreal, has been elected managing director of the Amulet, operating in the Rouyn area of Quebec.

J. D. HUNGERMAN, president of the Seafoam Mines Company, was in Boise recently on business with reference to completion of a 5-mile transmission line and completion of the fifty-ton flotation plant.

Dr. R. C. WALLACE, professor of geology in the University of Manitoba, is conducting a special course in geology at Winnipeg, which is attended by prospectors and others interested in mining.

DOUGLAS G. H. WRIGHT, consulting engineer and geologist, formerly located in the Royal Bank Building, has now moved his office to 304 McKinnon Building, corner Jordan and Melinda Sts., Toronto.

WALTER DOUGLAS and P. G. BECKETT president and managing director of Phelps Dodge Corporation, recently paid visits of inspection to the Old Dominion mine at Globe and the Copper Queen mines at Bisbee.

Dr. A. L. HALL, of the South African Geological Survey, left Pretoria on Oct. 20, for Cape Town, on special museum work and matters connected with the international Geological Congress to be held in Pretoria in 1928.

LOUIS E. HANLEY, superintendent of the Hecla Mining Company, at Burke, Idaho, recently was elected president of the University of Idaho Alumni Association. Mr. Hanley received his degree from the university in the class of 1900.

WILLIAM P. HULEATT, assistant professor of geology at the Colorado School of Mines, has returned to Golden after spending three months in Canada with the Canadian Exploration Company. He was doing structural work in the vicinity of Calgary and Peace River, B. C.

C. B. BRODIGAN, till recently general manager of the Brakpan Mines, Ltd., has arrived at Cape Town. He is paying a short visit to the Rand previous to taking up a new position in London with the same group—the Anglo American Corporation of South Africa, Ltd.

M. JABIOL, of Schlumberger Electrical Prospecting Methods, is in Spokane, Wash., having just completed an electrical survey of a property in northern Idaho. Mr. Jabiol recently returned from Canada, where he was engaged for several months in making similar surveys.

CHARLES F. WILLIAMS, district mining engineer of the U. S. Geological Survey, at Miami, Okla., and Mrs. Williams returned to this country recently from a six weeks' tour of Europe. Mr. Williams, who is commander of the American Legion Post at Miami, attended the Legion Convention in Paris.

EDGAR KOCH, for many years German consul in Parral, has taken over the management of the Minas Nuevas, 9 kilometers out of Parral, and of the Los Azules, 10 kilometers up the canyon from the San Francisco del Oro properties. He is disposing of the obsolete material and preparing both mines for active production.

JAMES F. MCCARTHY, of Wallace, Idaho, president and general manager of the Hecla Mining Company, after attending the recent meeting of the directors in Milwaukee, went to Washington and New York. He is still in the East and will attend the meeting of the American Mining Congress in Washington Dec. 1 to 3.

WYNDHAM KELLY has recently been appointed acting manager of the Consort Mine, Barberton. Mr. Kelly graduated in mining engineering at the Witwatersrand University and was awarded a Rhodes scholarship. At Oxford he gained his honor B.A. in engineering. For the last two years he has been on various mines of the Bailey group.

H. A. KEE, who sank the 4,000-ft. McIntyre No. 11 shaft, has been engaged by the Mond Nickel Company to sink a shaft on the Frood mine from 2,000 to 3,000 ft. Mr. Kee has just finished the McIntyre shaft and he will take a trained crew from this work to the Mond, as well as a considerable part of the sinking equipment which was on the McIntyre.

G. G. GRISWOLD, chief metallurgist of the Timber Butte Mining Company (W. A. Clark estate), spoke on "Differential Flotation" at a meeting of the Montana Society of Engineers held in Butte on Nov. 14. He stated that flotation, originally confined to thick oil, now embraces some twenty reagents, both organic and inorganic. After Mr. Griswold's address, a film was shown covering the building of the newest New York subway.

ALFRED BERGMAN, European representative of the Anaconda Copper Mining Company, is visiting the American plants of the company and recently was in Butte. He says that Germany is today using 260,000,000 lb. of copper annually, an amount greater than the combined consumption of England and France and that the Copper and Brass Research Association in Germany is doing good work in promoting the more extensive use of copper.

OBITUARY

E. LIGERTWOOD, late managing director of the Komati United Mines, Ltd., died in Johannesburg on Oct. 10.

CHARLES B. MANVILLE, founder of the Johns-Manville Company and its associated corporations, died in Pleasantville, N. Y., on Nov. 26. He was born in Watertown, N. Y., in 1834. Mr. Manville was the discoverer of the great value of asbestos as an insulating material, and with his sons, after acquiring the H. W. Johns Company, virtually controlled asbestos production on this continent through the ownership of the asbestos deposits of Quebec. He retired from business in 1902. Mr. Manville's son, H. Edward Manville, is reported to be seriously ill in Baltimore.

CHARLES HOSMER, vice-president of the Consolidated Mining & Smelting Company of Canada, died at his home, in Montreal, on Nov. 13. He was born at Corteau Landing, in the Province of Quebec, and after an ordinary school education entered the service of the Grand Trunk Telegraph Company as an operator. He later entered the employ of the Dominion Telegraph Company, in which he rose to be superintendent and president. In 1886 he was appointed manager for the Canadian Pacific Telegraph Company. At the time of his death, besides being vice-president of the Consolidated company, he was a director of the following companies: Canadian Pacific Railway, Bank of Montreal, Sun Life Association of Canada, Halifax & Bermuda Cable, and West Indies Cable.

MARKET AND FINANCIAL NEWS

Big Reduction in Stocks of "Standard" Copper

Apropos of the active buying of "standard" copper, in London, George L. Walker, London correspondent for the *Mines Handbook Copper Survey*, makes the following comment:

"Apparently the final steps are being taken to clean up the British stocks of rough copper which in the past have been used with such telling effect to control the price of the metal. Standard copper is being bought with a persistency and disregard of prices that can mean nothing else than accumulation. Deliveries against these purchases will have to be made from the relatively small stocks of rough copper that remain in warehouses. The copper so to be secured undoubtedly will go to the United States and there be refined, as many thousands of tons already have gone. By this means the wide and irregular fluctuations in the price of standard copper, which have caused so much annoyance in the past, are expected to be made impossible.

"The job of cleaning up the British stocks of 'rubbish' copper has been in hand for nearly two years. At the end of October last year there were 33,982 long tons of rough copper in warehouses—that representing a reduction of some 16,500 tons during the preceding ten months—and on Oct. 31 this year only 13,436 long tons. This is a decrease of 20,546 tons in twelve months, and as stocks of refined meanwhile have been reduced from 4,025 to 1,947 tons, there are 22,624 long tons, or 50,677,760 lb., less copper in British warehouses now than a year ago.

"This heavy reduction in the stocks of rough copper already has had a marked influence on prices. It is true that it has not put them up, because it has occurred during a year of declining prices; but on Nov. 1, 1926, standard copper, then being used as a club to beat down the market, was selling £9 per ton lower than electrolytic, and on the corresponding date this year it was only £5 15s. lower. The order has been reversed, and standard is now helping to advance the price of electrolytic."

Imports and Exports of Ores and Metals in October, 1926 and 1927

Compiled from U. S. Department of Commerce Records
In Pounds Unless Otherwise Stated

Imports

	October 1926	October 1927
Antimony:		
Ore, Gross weight	313,347	481,314
Ore, Antimony content	179,065	244,174
Liquated regulus or metal	2,537,814	1,318,163
Copper		
Ores, copper content	4,467,377	6,999,850
Concentrates, copper content	7,829,825	2,058,527
Regulus, coarse metal, cement copper	523,255	176,850
Imported from:		
Spain	1,129,439	653,994
Canada	3,772,414	4,096,927
Mexico	1,341,060	3,695,254
Cuba	2,734,729	.....
Cnile	3,231,767	672,218
Peru	247,487	.....
Other countries	363,561	116,834
Unrefined black, blister, converter Copper in pigs, bars, and other forms	46,523,584	37,296,679
Refined copper	10,603,584	6,086,531
Old and clippings for remanufacture	656,559	682,371
Composition metal, copper chief value	243,719	.....
Brass		
Old and clippings for remanufacture	598,393	442,540
Lead		
Ore, matte (lead content)	6,708,880	4,831,218
Bullion or base bullion	14,079,129	18,859,589
Pigs, bars, and scrap	694,072	254,418
Babbitt, solder and other forms, lead content	329,488	157,535
Type metal, antimonial lead, Gross weight	2,194,049	.....
Type metal, antimonial lead, Lead content	2,043,150	.....
Manganese		
Ore, tons, Cuba, manganese content	.....	140
Ore, tons, Other countries, manganese content	13,331	14,780
Pyrites, tons	31,956	23,721
Tin		
Ore, tons	11	12
Bars, blocks, pigs	11,481,283	16,080,871
Imported from		
Netherlands	1,964,517	1,120,208
United Kingdom	2,255,414	1,931,322
British Malaya	5,704,954	12,820,433
Netherlands East Indies	1,196,242	.....
Hongkong	235,548	27,510
Australia	112,000	100,800
Other countries	12,608	80,598
Zinc		
Ore, zinc content, Free	116,572	.....
Ore, zinc content, Dutiable	3,405,494	.....
Blocks, pigs, and old	7,665	9,270

Exports

	October 1926	October 1927
Copper		
Ores, composition, concentrates, unrefined	500	545,390
Refined, copper in ingots and other forms	67,555,863	74,482,032
Exported to:		
Belgium	3,904,034	7,812,212
France	12,048,762	9,987,742
Germany	15,974,194	13,972,880
Italy	7,614,313	5,460,223
Netherlands	5,586,206	8,070,078
Spain	.....	148,205
Sweden	2,365,538	2,267,635
United Kingdom	12,899,590	17,263,249
Other Europe	444,241	7,539,745
Canada	808,781	1,199,093
British India	672,247	.....
China, Hongkong, Kwantung	56,340	114,323
Japan	5,061,545	335,939
Other countries	120,072	310,708
Old and scrap	987,682	2,805,316
Pipes and tubes	293,652	212,508
Plates and sheets	351,240	308,665
Rods	3,191,340	4,446,995
Wire	1,045,319	378,439
Insulated copper wire and cable	1,465,608	1,020,312
Lead		
In pigs, bars, and other forms	11,788,779	22,897,209
From domestic ore	126,168	71,640
From foreign ore	11,662,611	22,825,569
Exported to:		
Belgium	112,047	224,042
France	504,121	3,697,246
Germany	3,696,744	2,520,742
Netherlands	448,157	.....
Sweden	840,212	705,882
United Kingdom	2,688,889	11,203,888
Other Europe	560,117	589,456
Brazil	112,028	324,867
Other South America	121,178	94,575
China, Hongkong, Kwantung	.....	.....
Japan	2,577,048	3,361,992
Other countries	128,238	174,519
Other lead manufactures	2,573,546	480,044
Zinc		
Ores and concentrates, tons	4,795	1,722
Dross	2,164,409	486,836
Cast in slabs, blocks, or pigs	9,732,484	9,880,701
Exported to:		
Belgium	.....	56,000
France	840,122	854,957
Germany	112,002	.....
Italy	336,136	336,189
Netherlands	96,912	109,628
United Kingdom	5,210,445	4,258,013
Other Europe	55,985	1,100
Argentina	1,994,637	964,318
British India	.....	.....
Japan	952,162	3,191,403
Other countries	134,083	109,093
Sheets, strips, other forms	946,423	630,267
Dust	253,785	462,630
Other zinc manufactures	253,239	218,405

Slight Decline in Rate of World's Lead Production—Increase in Zinc

DATA just issued by the American Bureau of Metal Statistics, showing the world's production of lead and zinc for October, reveal the fact that the daily rate of lead production from countries producing 90 per cent of the estimated total is 4,474 tons, compared with 4,490 tons in September. The peak was reached in March, when the rate was 4,658 tons per day. Responsibility for the continued high rate rests with the United States, principally, although a small increase is shown for Canada. European countries, on the other hand, particularly Spain, reduced their rates of output, as did Australia. If the United States had shown a corresponding decline, the net rate would have been much lower.

So far as the United States is concerned the situation is much the same in zinc. Belgium reports a small increase, and the declines in the other countries are not sufficient to offset the increases in the United States and Belgium, so that a small net increase from 3,824 to 3,908 tons from countries producing about 96 per cent of the total is the result. The probable reason for the upward trend in America is the increased production of so-called complex ores of lead and zinc in the Rocky Mountain region. That this is so is indicated by the synchronism shown in the figures for both of the metals. The accompanying tables reflect the world situation for the last five months.

Estimated Zinc Production of the World

In Short Tons

	June, 1927	July, 1927	Aug., 1927	Sept., 1927	Oct., 1927	Jan.-Oct., 1927
United States	49,718	47,627	49,012	47,735	50,185	511,984
Canada	5,511	6,074	6,778	7,104	7,322	58,282
Mexico	513	595	602	599	635	5,607
Belgium	18,186	18,249	17,977	17,228	18,781	183,829
France	7,524	7,624	7,527	7,304	7,821	74,766
Germany	7,692	7,880	7,762	7,507	7,826	76,270
Great Britain (a)	4,984	5,152	5,040	4,704	5,376	45,841
Netherlands	2,398	2,431	2,388	2,400	2,447	24,134
Poland	1,937	1,955	1,940	(b) 1,900	(b) 1,900	18,614
Polish Silesia	11,956	12,468	12,575	12,236	12,749	119,490
Spain	1,544	1,624	1,563	1,500	1,512	15,494
Australia	4,570	4,722	4,722	4,502	4,583	46,015
Totals	116,533	116,401	117,886	114,719	121,137	1,180,326
Estimate for non-reporting countries	4,000	4,000	4,000	4,200	4,200	39,900
World's totals	120,500	120,400	121,900	118,900	125,300	1,220,200

(a) Estimated by International Metal Service. (b) Estimated.

Monthly Zinc Production by Countries Enumerated Above

In Short Tons

	1926 Monthly Production	1926 Daily Rate	1927 Monthly Production	1927 Daily Rate
January	112,037	3,614	121,222	3,910
February	107,252	3,834	111,501	3,982
March	115,086	3,712	123,852	3,995
April	112,653	3,755	116,363	3,879
May	111,953	3,611	120,712	3,894
June	103,467	3,449	116,533	3,684
July	104,378	3,367	116,401	3,755
August	109,006	3,516	117,886	3,803
September	107,673	3,589	114,719	3,824
October	114,353	3,689	121,137	3,908
November	114,148	3,805	.....	.....
December	118,591	3,826	.....	.....
Totals	1,320,697	3,646	1,180,326	3,883
Monthly average	110,891	.....	118,033	.....

Estimated Lead Production of the World

In Short Tons

	June, 1927	July, 1927	Aug., 1927	Sept., 1927	Oct., 1927	Jan.-Oct., 1927
United States (a)	58,391	57,059	55,830	53,204	56,740	573,364
Mexico	21,328	24,444	22,752	22,661	23,222	222,867
Canada	12,037	12,420	12,372	13,191	13,958	125,693
Total No. America (b)	91,756	93,923	90,954	89,056	93,920	921,924
Spain and Tunis (c)	12,107	10,255	8,925	9,317	8,802	108,966
Italy	1,989	2,846	2,525	(d) 2,227	(d) 1,852	21,087
Germany	8,696	7,998	8,753	9,706	(d) 9,000	81,196
Polish Silesia	1,691	1,899	1,726	1,943	(d) 1,900	19,662
Australia	14,629	17,410	16,110	15,725	16,006	154,837
Burma	6,125	6,160	6,231	6,160	6,637	60,046
Rhodesia	560	560	560	567	571	5,602
Total	137,553	141,051	135,784	134,701	138,688	1,373,320
Est. for non-reporting countries (e)	15,300	15,700	15,100	15,000	15,400	152,600
World's total	152,800	156,700	151,000	149,700	154,100	1,525,900

(a) Crude lead, including some from South American ore. (b) The distribution according to countries is not precise, particularly as between the United States and Canada. (c) Partial. (d) Estimated or partly estimated. (e) Estimated on the assumption that unenumerated countries produce 10 per cent of the total, which was substantially the percentage in 1926.

Monthly Lead Production by Countries Enumerated Above

In Short Tons

	Tons	1927 Daily Rate		Tons	1927 Daily Rate
January	138,808	4,478	August	135,784	4,380
February	127,718	4,561	September	134,701	4,490
March	141,411	4,658	October	138,688	4,474
April	137,924	4,597			
May	136,662	4,409	Total	1,373,320	4,518
June	137,553	4,585	Monthly average	137,332	
July	141,051	4,550			

STATISTICAL NOTES

SILVER PRODUCTION for the world shows no definite signs of declining, according to the latest figures of the A. B. of M. S. For August, the most recent month for which complete figures are available, the total was 20,178,000 oz., compared with 19,140,000 for July and 16,697,000 for August in 1926. All of these figures include the production of countries that in 1926 produced 88 per cent of the world's total. Based on averages for ten months, rates of production in both the United States and Canada are somewhat lower than in 1926. The following figures show the position:

	1926	1927
United States (ten months) ounces	5,077,000	4,930,000
Canada (ten months), ounces	1,771,000	1,730,000

The biggest factor in silver production is Mexico, and with August showing 9,372,000 oz., compared with 9,197,000 in July, a decline does not seem very likely.

ASBESTOS PRODUCTION in Quebec established a new high record in 1926, according to the U. S. Department of Commerce. The total was 279,389 tons, having a value of $10,095,487, increases of 2.2 and 13.8 per cent respectively over the previous year. The quantity of rock mined was 4,483,361 tons. In 1926 134.3 lb. of asbestos, having a value of $2.35, was produced for each ton of rock hoisted, compared with 129.7 lb., valued at $1.95, for 1925, and 124 lb., valued at $1.83, for 1924.

CHIEF CONSOLIDATED MINING COMPANY, operating in Utah, netted $16,429 as operating profit during the third quarter of 1927, from the shipment of 18,381 tons of ore. Total profit on operations for the first nine months of the year was $179,398. After paying bond interest and taxes and crediting miscellaneaus income, the net profit was $109,677.

The Market Report

Copper, Lead, and Silver Prices Advance in Active Metal Market

New York, Nov. 30, 1927.—Few pessimists can be found in the ranks of the metal producers as an active November comes to an end. Sales of practically all metals have been phenomenally good all month, and prices of copper, tin, lead, zinc, and silver have advanced as a result. Copper has done particularly well, advancing $\frac{5}{8}$c. during the month. Lead and zinc dropped to new lows early in November, but have since more than made up the loss. Tin and silver have been irregular, but the first named is 1½c. higher today than on Nov. 1, and silver is up 1¼c.

Whereas, until recently, manufacturers have been buying metal only from hand to mouth, much more of an inclination to buy for forward delivery is now manifest, as they seem assured of a good demand for their products during the winter and early spring. Therefore, more metal has been bought in November than has been consumed. Should manufacturers go back to their old practice of providing only for immediate requirements, a pronounced lull in the metal markets would surely result, but no particular fears are entertained on this score.

Daily Prices of Metals

Nov.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
24	Holiday	.....	.....	.....	.....	...
25	13.525	58.00	58.75	6.25	6.075@6.10	5.85
26	13.55	58.25	59.00	6.25@6.275	6.075@6.10	5.85
28	13.525	58.00	58.75	6.25@6.325	6.125	5.875
29	13.525	58.125	59.125	6.40@6.425	6.125@6.20	5.875@5.90
30	13.65	58.25	58.875	6.40@6.45	6.225	5.85
	13.555	58.125	58.900	6.328	6.138	5.863

Average prices for calendar week ending Nov. 26, 1927, are: Copper, 13.520; 99 per cent tin, 57.950; Straits, 58.525; N. Y. lead, 6.253; St. Louis lead, 6.068; zinc, 5.868; and silver, 57.725.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
24	58⅞	59⅛	64¼	265¾	263¾	21⅜	21 13/16	26 9/16	26 3/16
25	59⅛	59 5/16	64¼	266¼	264½	21 7/16	21 13/16	26⅝	26¼
28	59 5/16	59½	64¾	267	265½	21⅝	21 15/16	26¾	26 9/16
29	59 1/16	59 5/16	64¾	267⅜	265⅝	21 13/16	22	26⅝	26 5/16
30	59 7/16	59 11/16	65	268	265⅛	22	22 3/16	26⅝	26 5/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
24	Holi	day	26 9/16	84s11½d	28	4.87 5/16	57⅞	26¾	84s11½d
25	4.87⅜	58⅛	26⅜	84s11½d	29	4.87 7/16	57⅞	26¾	84s10½d
26	4.87⅜	57⅞	26 11/16	.....	30	4.87 5/16	58⅛	26 15/16	84s11¼d
					Avg.		57.975		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Average Metal Prices for November, 1927

COPPER:	
New York Electrolytic	13.319
London Standard Spot	58.830
London Electrolytic Spot	63.761
LEAD:	
New York	6.259
St. Louis	6.035
London Spot	20.889
London Forward	21.318
SILVER:	
New York	57.474
London	26.526
Sterling Exchange	486.956
ZINC:	
St. Louis	5.745
London Spot	26.281
London Forward	26.006
TIN:	
99 per cent	57.089
Straits	57.641
London	262.591
QUICKSILVER	127.708
ANTIMONY	10.763
PLATINUM:	
Refined	72.000
Crude	62.000
ALUMINUM, 98 PER CENT	25.000

Copper Touches 14c. in Detroit

Until yesterday, copper sellers generally adhered to the 13¾c. level in the East, and 13⅞c. delivered in the Middle West, with some offerings and sales at 2½- to 5-point concessions in the East. Business yesterday was so large, however, with two or three particularly heavy orders, that an overnight advance was general. Today, sales have been made all the way between 13.80c. delivered in the East to 14c. in Detroit and other Mid-Western territory. This is the fifth consecutive week of excellent copper business. January has been in most demand, with February next, but well over 2,000 tons has been booked for December shipment.

The foreign market has also been strong, and the price was advanced from 14.05c., c.i.f., to 14.15c. today. About 60,000 tons has been sold by the export association during November.

Zinc Quiet but Firm

The last week has been a quiet one for zinc, following a more active week than any other in a year or more. Prices have been well maintained at around 5.85c. for December shipment, however, and somewhat higher for deliveries further forward. Today, little interest by

consumers is reported, but with the higher prices asked for concentrates in the Tri-State district, smelters are holding firm. High-grade continues nominally at 7¼c. delivered in the East for spot carloads. Prime Western in New York is at the customary freight differential of 35c. per 100 lb. above St. Louis.

New York Lead Passes 6.40c.

After maintaining its New York price for common lead at 6.25c. per lb. for eleven weeks—since Sept. 9, when the price was cut from 6.40c.—the American Smelting & Refining Company on Monday, Nov. 28, advanced its official quotation $1 per ton to 6.30c., and the next morning made a further advance to 6.40c. London had shown moderate but sustained strength for several days, and with sentiment in the domestic market improved by the general optimism as to the industrial outlook, the Smelting company made the small advance, possibly as a "feeler." The response was increased inquiry from consumers, and the second advance followed promptly. Several good sales have been made at 6.45c. yesterday and today. The St. Louis market was even more active than that in the East, and the price was marked up during the week from 6.075c. to 6.22½c. With the exception of one large order, spread over January, February, and March, most of the sales were for prompt, December, or January delivery, with December predominating. Corroders and storage-battery interests have shown less interest than makers of armored cable and "blue lead" products. Statistics do not reflect much curtailment, but reliable reports from mining districts seem to indicate that smelter production has been lessened to a material extent. Corroding grades of lead are commanding the usual premium of from $2 to $3 per ton.

Higher Tin Prices

Backing and filling have characterized the tin market during the week. London on Tuesday ignored a decline in the New York market on the preceding day, and as a consequence the domestic prices stiffened again. Dealers have traded actively, but consumers likewise have been in the market. Prompt Straits is not overly plentiful, and it commands a premium, though very slight, over forward positions.

Foreign Exchange Steady

Sterling exchange is slightly easier. Other foreign exchanges, according to closing cable quotations on Tuesday, Nov. 29, are: francs, 3.93½c.; lire, 5.43¾; and marks 23.89¼c. Canadian dollars, ⅝ per cent premium.

Silver Quiet and Steady

The silver market has continued steady during the week, being supported by moderate buying from India for shipment and to cover up bear positions.

Mexican Dollars (Old Mexican pesos): Nov. 24th, holiday; 25th, 44¾c.; 26th, 28th and 29th, 44½c.; 30th, 44¾c.

Zinc Ore Again Advanced

Joplin, Mo., Nov. 26, 1927

Blende	Per Tons
High	$41.80
Premium blende, basis 60 per cent zinc	$38.00@39.00
Prime Western, basis 60 per cent zinc	37.00
Fines and slimes, 60 per cent zinc	34.00@36.00
Average settling price, all zinc	36.32
Galena	
High	$82.00
Basis 80 per cent lead	80.00
Average settling price, all lead	80.88

Shipments for the week: Blende, 90,976; lead, 2,539 tons. Value, all ores the week, $567,740.

Shipment for eleven months; Blende, 614,792; lead, 91,281 tons. Value, all ores, eleven months, $33,471,530.

The company first to advance the price a week ago was in the market on Monday of this week with another advance of $1. Offerings on the $37 basis today, however, were restrained, so only 6,440 of the 13,000 tons produced was sold. The decrease in production in the last month amounts to approximately 2,000 tons.

Platteville, Wis., Nov. 26, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$38.75
Lead Ore	
Lead, basis 80 per cent lead	$80.00

Shipments for the week: Blende 1,068 tons; lead 280 tons. Shipment for the year: Blende, 58,974; lead, 1,845 tons. Shipment for the week to separating plants, 1,835 tons blende.

Fair Business in Spot Steel

Pittsburgh, Nov. 29, 1927

Steel demand is holding up well in these closing weeks of the year, when there is usually a decline unless wants of the new year are being anticipated, and there is now no anticipating. Production stays at the steady pace maintained since the middle of the year, at about 68 per cent of full capacity, measured in ingot output.

In prices there are divergent trends. The recent advance of a dollar a ton in bars, shapes, and plates to 1.80c. Pittsburgh is fully maintained, and mills are endeavoring, furthermore, to secure 1.85c. or 1.90c. on lots of less than 100 tons. Contracts are being made at 1.80c. for first quarter, evidently looking to an advance in the ordinary market to 1.90c. On the other hand, both strips and sheets have weakened farther. Black sheets are now at 2.75c. to 2.80c., with galvanized at 3.60c. to 3.70c. Automobile sheets in general remain at 4.15c., but some Ford orders have been booked at 4.00c., a concession being usually made on such business. Pipe is steady and an advance in nails is again predicted.

Pig Iron.—The Standard Sanitary Manufacturing Company business went at $17.25, Valley, for No. 2 and $17.50 for No. 2X, about 30,000 tons, first half delivery, being involved. The market had been nominal at $17.50. Furnaces are quite ready to sell prompt at $17.25, but some will not make the price for such extended delivery. Bessemer, $18; basic, $17; foundry, $17.25@$17.50, f.o.b. Valley furnaces.

Connellsville Coke—The market remains dull, and prices are unchanged. Heating, $2.50@$2.65; furnace, $2.75@$2.90; foundry, $4@$4.75.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 99 and 98 per cent grades, price of leading interest, 25c.; outside market, 24.30@24.80c. London, 98 per cent, £104@£107 per long ton for domestic consumption.

ANTIMONY—Per lb., duty paid, spot: Chinese brands, 10¾c.@10⅞c. Market quiet. Mexican R.M.M. brand, 11⅝c. Cookson's "C" grade, spot, 16⅜c.

Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c. White oxide, Chinese, 99 per cent Sb_2O_3, 15½c. Nominal.

BISMUTH—Per lb., in ton lots, $1.85@$2.10. London, 8s. Domestic market continues below London parity.

CADMIUM—Per lb., 60c. London, 1s. 11d. for Australian metal.

COBALT—Per lb., f.o.b. Canadian works: Shot, 96@98 per cent, $2.50. Black oxide, 70 per cent, $2.10. London, 10s. for metal; 8s. for black oxide; 8s. 10d. for gray.

[1]GERMANIUM OXIDE—Per gram in 300- to 500-gram lots, $5.

IRIDIUM—Per oz., $110@$115 for 98 @99 per cent sponge and powder. London, £20@£25.

LITHIUM—Per oz., 98@99 per cent grade in 1- to 5-lb. lots, $1.55.

MAGNESIUM—Per lb., in ton lots: 8-lb. ingots (3x3x16 in.), 98c.; 3-lb. sticks (1⅜x33 in.), $0.95@$1; 10-oz. sticks (1x12 in.), 85@90c. Market quiet. London 3s. 9d.@4s. 3d. for 99 per cent ingots or sticks.

[1]MOLYBDENUM—Per gram, 99 per cent, 2½c.; chemically pure metal, 8c. (Usually sold as calcium molybdate or ferromolybdenum, which see).

MONEL METAL—Per lb. base price for shot, 28c., f.o.b. Huntington, W. Va.

NICKEL—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade), for single lots of spot metal. Fair demand. London, per long ton, £170@£175 according to quantity. Business fair.

OSMIUM—Per oz., $60@$65; London, £11@£13.

PALLADIUM—Per oz., $51@$52. Small lots bring up to $55. London £10¼@£11. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $72. Dealers and refiners quote the trade for refined metal, per oz., $64@$65, cash. Market somewhat more active.

[1]Price furnished by Foote Mineral Co., Philadelphia.

London, per oz., £13⅝@£14 for refined; crude and scrap, nominal.

QUICKSILVER — Per 76-lb. flask, $127.50@$128.50. Active. San Francisco wires $129.17. London firm at £23.

RADIUM — Per mg. radium content. $70.

RHODIUM—Per oz., $50@$54; London, £8@£11½. Nominal.

RUTHENIUM — Per oz., $35@$38. Nominal. London, £6@£8½.

[1]SELENIUM—Per lb. in ton lots; Black, powdered, amorphous, 99.5 per cent pure, $1.90@$2. London, 7s. 8d. @7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 20c. Firm.

TELLURIUM—Per oz., 12½c.

[1]THALLIUM METAL—Per oz.: Ingot, 99 per cent pure, 95c. in 25-lb. lots.

TUNGSTEN POWDER — Per lb. contained tungsten, 97 to 98 per cent pure, $0.95@$0.98.

[1]ZIRCONIUM METAL—Per oz., 98 per cent grade, 95c. in 5- to 10-lb. lots.

Metallic Ores

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, $22.50@$23 for 45 to 50 per cent Cr_2O_3 ore. Prices firm.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores.

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.40.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range bessemer, 51½ per cent, $4.55.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 58 to 63 per cent, 8.75@9c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

Swedish and Norwegian, low-phosphorus, 68 per cent, 10½@10¾c.

North African, low-phosphorus, 11 @11½c.

Spanish foundry or basic, 50@54 per cent, 9.50@9.75c. Nominal.

Swedish foundry or basic, 66@68 per cent, 9.50@9.75c.

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c. Caucasian (washed), 53@55 per cent, 38.50@40c.

Per ton in carload lots:

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, $70@$80. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of Ta_2O_5, basis 65 per cent ore, $13.

TITANIUM ORE—Ilmenite, per gross ton, 52 to 60 per cent TiO_2, f.o.b. Atlantic seaboard, $10@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., 96 per cent concentrate, 11c. to 13c.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $10.05@$10.20, Western scheelite, $10.35@$10.50. Market dull, prices largely nominal.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]AMBLYGONITE—Per ton, f.o.b. mines: 8@9 per cent lithium oxide, $50@$60.

ASBESTOS—Per ton: f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest:

Crude No. 1, $650; crude No. 2, $400 @$500; spinning fibers, $200@$225; magnesia and compressed sheet fibers, $160@$175; shingle stock, $75@$125, various grades; paper stock, $45@$50; cement stock, $25; short fibers, $10@ $20; floats, $15. Market very active for all grades above paper stock. Higher prices quoted on crude, compressed sheet and shingle stock.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per long ton: f.o.b. mines, bags extra:

Georgia: Barytes ore, crude, $7. Wet ground, off color, $12@$18, depending on analysis. Shipments steady.

Missouri: Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, per ton, $8, f.o.b. mines. Market fair.

BAUXITE — Per long ton: No. 1 chemical ore, over 60 per cent Al_2O_3, less than 5 per cent SiO_2, and less than 2 per cent Fe_2O_3 $8, f.o.b. *Georgia* mines. Pulverized and dried $14; calcined $18@$20.

Per metric ton, foreign, c.i.f.: Dalmatian, low SiO_2, $5@$6.50; Istrian, $5.50@$7; French, red, $6@$7.50.

BORAX—Per lb.: Carload lots, in bags, crystals, 4c.; granulated or powdered, 3¾c.; f.o.b. plant, Pennsylvania. Keen competition in market.

[1]CELESTITE—Per ton in carload lots: 90 per cent $SrSO_4$, finely powdered, $27.

CHALK—Per ton: Crude in bulk, c.i.f. *New York,* $4.75@$5.

CHINA CLAY (KAOLIN)—Per ton: F.o.b. *Virginia* mines, crude lump, No. 1, $7: crude No. 2, $5.50; washed, $8; powdered and air-floated, $10@$15; ground, $7@$10.

Florida, pressed pottery, bulk, $13; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour No. 1, $20; No. 2, $17. Market dull.

Best grade, domestic, $16@$18, f.o.b. *Delaware* plants in carload lots.

Imported English, f.o.b. American ports: Lump, $13@$21: powdered, $45@$50. English Clay Producers Association has announced an advance of $2 per ton on lower-priced grades for 1928.

DIATOMITE — Per short ton, f.o.b. plant:

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $25; natural aggregate, ¼ in. $20; air-floated powder, $45. Over 85 per cent silica, 98 per cent through 200 mesh, $25@$26, depending on quantity. Market fair to good.

EMERY — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½c. Market good.

FELDSPAR—F.o.b. mine or grinding plant:

North Carolina, per long ton, No. 1 pottery grade, crude, $6@$7.25. Demand good.

New Hampshire, per ton: Pottery grade, $8.50. Best quality lump, $9. Market good.

New York, Per ton: f.o.b. cars, No. 1 crude, $9. Market very quiet.

Tennessee, per ton: No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 140 mesh, $13.50; 200 mesh, $15; increased demand.

Maine, per ton: Best pottery grade, ground, $19. Market fair.

FLUORSPAR—Per ton: F.o.b. *Kentucky* and *Illinois* mines.

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $16. Quiet. Foundry lump, 85-5, $18. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Demand extremely quiet because of slackness in steel operations.

New Mexico: 85-5 gravel, $16.50; 85-5 lump, $16.50; 90-4 lump, $19.50; 96-3 ground, 100 mesh, $32.50, bulk. Market good.

Foreign spar, duty paid, $16@$16.25, tidewater.

FULLER'S EARTH — Per ton, f.o.b. ***Florida:*** 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 60 to 100 mesh, $14; 100 mesh up, $8; 200 mesh up, $14. Market fair at unchanged prices.

Powdered, import duty paid, $24@ $25 per ton.

GARNET — Per ton: domestic, f.o.b. mines, $85. Market easy.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE — Per ton, carload lots, f.o.b. mines *Colorado:*

Selected grade, $33; seconds (mine run), $25.50.

GRAPHITE — Per ton: F.o.b. *New York.*

Ceylon lump, 8@8½c.; chip, 7@7½c.; dust, 3@5½c.; Madagascar flake, 7@7½c. Market fair.

No. 1 flake, 8c. and up. Foundry facings, 3c. and up. Amorphous and crystalline, fine ground, 3c. and up. Crude amorphous graphite, $15@$35 per ton, according to grade.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade in carload lots, $25. More inquiries indicate better business.

[1]**Price furnished by Foote Mineral Co., Philadelphia.**

GYPSUM—Per ton, f.o.b. mill, depending upon location: Crushed, $2.75@$3; ground, $4@$10; agricultural, $6@$15; calcined, $8@$10.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 2½@4½c.; domestic earth, 2@4½c.

KAOLIN—See China Clay.

[1]LEPIDOLITE—Per ton: $20@$30 for ordinary grades. Nominal.

LIMESTONE—Per ton: f.o.b. shipping points, depending on location, either lump or crushed, 75c.@$2.

Agricultural, 75c. up to $4 or $5 for crushed or pulverized. Prices depend upon source, purity, and fineness.

MAGNESITE — Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $40; grade B, $38; dead burned, $30@$32; crude, $14. F.o.b. Eastern seaboard, calcined, $40.

MICA—Per ton, f. o.b. plant:

New Hampshire: Mine run, $300; clean shop scrap, $25; mine scrap, $22. White dry ground, 20 mesh, $25; 40 mesh, $40; 60 mesh, $65; 100 mesh, $80; 200 mesh, $100. Market fairly active and somewhat firmer.

North Carolina: White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, dark, free from iron, per lb., f.o.b. *New York*, duty paid: No. A1, $3.50@$4; No. 1, $3; No. 2, $2.50; No. 3, $1.30; No. 4, 70@80c.; No. 5, 45c. Market strong.

[1]MONAZITE—Per ton: (Minimum 6 per cent ThO_2), $120.

OCHER — F.o.b. *Georgia* mines, per ton: $19@$20 in sacks; $21@$22 in barrels; washed and water floated, $18; second grade, 99 per cent through 225 mesh, $18. Market weak.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10; 66 per cent, $4. Prices firm.

Florida, pebble, domestic: 76@77 per cent, $6; 74@75 per cent, $5; 72 per cent, $4; 70 per cent, $3.50. Market fair.

Tennessee, ground, 97 per cent through 200 mesh, 33 per cent P_2O_5, $9.40 per ton. Brown lump for acid manufacture, per gross ton, $5.50 on 75 per cent basis; $4.50 on 72 per cent basis.

POTASH—The ruling contract prices are as follows:

	Bags	Bulk
Muriate of potash 80 @ 85 per cent, basis 80 per cent....	36.40	34.80
Sulphate of potash 90 @ 95 per cent, basis 90 per cent....	47.30	45.70
Sulphate of potash-magnesia 48 @ 53 per cent, basis 48 per cent	27.25	25.65
Manure salt 30 per cent.....	21.75	18.75
Manure salt 20 per cent.....	15.40	12.40
Kainit 14 @ 16 per cent.....	12.50	9.50
Kainit 12.4 per cent.....	12.00	9.00

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

PUMICE STONE—Per lb.: In barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur: Tharsis, c.i.f. U. S. ports; guaranteed 48 per cent sulphur, furnace size, 2½-in. diameter, 14c. Same price for fines screened through ½-in. mesh. Cinder from ore to remain property of buyers. Excellent inquiry but few orders.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots: Colorless, clear and flawed, pieces ¼ to ½ lb. in weight, 40c. For optical purposes, double above prices; larger crystals still higher.

SILICA—Per ton: Water ground and floated, in bags, f.o.b. Illinois; 400 mesh, $31; 350 mesh, $26; 250 mesh, $18. Market fair. Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35 @$3.50.

[1]SPODUMENE — Per ton: $20@$30, depending upon lithium content. Nominal.

SULPHUR—Per ton for domestic market, $18, f.o.b. Texas mines; $22 for export, Atlantic ports. Prices in reality are on a c.i.f. basis, but the average price reduced to an f.a.s. figure is about as given. Good shipment against contracts. Open prices $1 higher than above.

TALC—Per ton, carload lots, f.o.b. works, containers included:

Vermont: 99 per cent through 200 mesh, extra white, $10.50; 96 per cent through 200 mesh, medium white, $9.50; packed in 50-lb. paper bags. Competition active.

New York: Double air-floated, 200 mesh, $13.75; 325 mesh, $14.75. Demand fair.

Georgia: Powdered, gray, $7.50@ $10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9. Market fair.

New Jersey: Soapstone, ground, $10 @$12; market good.

TRIPOLI—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh; rose and cream colored, $14. Double ground through 110 mesh; rose and cream, $17. Air-floated through 200 mesh, rose and cream, $25; mill run, $15. Business good.

[1]ZIRCON—Per lb., f.o.b. mines in carload lots: 95 per cent, 3c.

Metallic Compounds

ARSENIOUS OXIDE (White arsenic)—Per lb. 4c. Quiet. London, per long ton, £18¼ for Cornish white.

CALCIUM MOLYBDATE OR MOLYTE — Per lb. of contained Mo, $1.20, delivered.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 5@5.10c., for either large or small crystals.

[1]Price furnished by Foote Mineral Co., Philadelphia.

SODIUM NITRATE—Per 100 lb.; crude, in bags ex vessel, Atlantic ports, $2.40 @$2.45 for spot; future delivery, $2.40.

SODIUM SULPHATE (Salt Cake)—Per ton, bulk, f.o.b. works, $17@$20.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6⅝c.; French red seal, in bags, 9⅜c.

Ferro-Alloys

[1]FERROCERIUM—Per lb., $5.50.

FERROCHROME—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 11@11½c.

FERROMANGANESE — Per gross ton furnace: Domestic and foreign, 78@82 per cent, $90. Spiegeleisen, 19@21 per cent, $30@$31 on carload business, f.o.b. furnace. Market dull.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.25. Business good.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee*.

FERROSILICON—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River: 50 per cent, $85; 75 per cent, $135; 14@16 per cent, $45. Market fairly active.

FERROTITANIUM—Per ton: For 15 to 18 per cent material, $200, f.o.b. Niagara Falls, N. Y.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, 92@94c., f.o.b. works. Better sentiment in industry; price advance likely.

FERROVANADIUM—Per lb. of V contained, f.o.b. works, $3.15@$3.50, depending on grade. Market good.

Metal Products

ROLLED COPPER—Sheets, 22¼c.; wire, 15½c. per lb., f.o.b. mill.

LEAD SHEETS—Full rolled 9¾c. per lb.; clipped, 10c.

NICKEL SILVER—28⅞c. per lb. for 18 per cent nickel Grade A sheets.

YELLOW (MUNTZ) METAL—Dimension sheets, 19½c. per lb.; rods, 16½c. per lb.

ZINC SHEETS—10c. per lb., f.o.b. works.

Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$45, *Ohio, Kentucky, Central Pennsylvania;* second quality $35 @$37.

MAGNESITE BRICK—Per net ton, f.o.b. works: 9-in. straights, $65.

SILICA BRICK—Per M., *Pennsylvania* and *Ohio*, $43; *Alabama*, $51; *Illinois*, $52.

[1]ZIRKITE—Per lb.: Powdered, 80 per cent ZrO_2, 3c. Brick, straights, 80c.@ $1 each.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London Spot		Sterling Exchange	
	1926	1927	1926	1927	1926	1927
January	67.795	55.795	31.322	25.863	485.295	484.775
February	66.773	57.898	30.797	26.854	485.852	484.551
March	65.880	55.306	30.299	25.655	485.606	484.887
April	64.409	56.399	29.682	26.136	485.702	485.178
May	65.075	56.280	30.125	26.072	485.485	485.288
June	65.481	56.769	30.248	26.203	486.000	485.183
July	64.793	56.360	29.861	25.983	485.755	485.145
August	62.380	54.718	28.773	25.224	485.293	485.546
September	60.580	55.445	27.904	25.565	484.845	485.878
October	54.505	56.035	25.291	25.776	484.475	486.533
November	54.141	57.474	25.192	26.526	484.359	486.956
December	53.466	.....	24.733	.....	484.553	.....
Year	62.107	.....	28.686	.....	485.268	.....

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		London Spot Standard		London Spot Electrolytic	
	1926	1927	1926	1927	1926	1927
January	13.822	12.990	59.013	55.414	65.325	62.375
February	13.999	12.682	59.669	54.438	66.375	61.119
March	13.859	13.079	58.603	55.935	65.489	62.641
April	13.706	12.808	57.200	55.056	64.600	61.526
May	13.599	12.621	56.494	54.563	64.313	60.881
June	13.656	12.370	56.778	54.030	64.591	59.881
July	13.924	12.532	57.864	54.551	65.625	60.089
August	14.174	12.971	58.857	55.364	66.857	62.227
September	14.062	12.940	58.705	54.455	66.528	61.830
October	13.862	12.958	58.304	55.119	66.298	62.256
November	13.576	13.319	57.293	58.830	65.551	63.761
December	13.302	.....	56.869	.....	64.114	.....
Year	13.795	.....	57.971	.....	65.472	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London			
	1926	1927	1926	1927	1926 Spot	1926 3 Mos.	1927 Spot	1927 3 Mos.
January	9.255	7.577	9.102	7.392	34.778	34.584	27.485	27.786
February	9.154	7.420	8.991	7.286	33.903	33.903	27.344	27.781
March	8.386	7.577	8.165	7.328	31.625	31.921	27.845	28.302
April	7.971	7.126	7.764	6.807	28.775	29.284	26.546	27.053
May	7.751	6.616	7.538	6.269	28.253	28.719	25.054	25.526
June	8.033	6.414	7.876	6.150	29.986	30.142	24.438	24.750
July	8.499	6.344	8.383	6.120	31.716	31.545	23.491	23.932
August	8.908	6.681	8.722	6.367	32.756	32.345	23.119	23.540
September	8.786	6.297	8.515	6.044	32.085	31.790	21.446	21.994
October	8.402	6.250	8.130	6.013	30.821	30.696	20.479	20.946
November	8.005	6.259	7.800	6.035	29.270	29.563	20.889	21.318
December	7.855	.....	7.688	.....	28.932	29.264	.....	.....
Year	8.417	.....	8.223	.....	31.075	31.146	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York		New York Straits		London Spot	
	1926	1927	1926	1927	1926	1927
	99%					
January	61.415	64.785	62.275	66.415	282.038	297.804
February	62.653	66.528	63.705	69.142	287.107	306.125
March	63.472	67.833	64.505	69.199	292.288	313.315
April	61.962	66.069	63.389	67.933	281.388	302.572
May	60.165	63.935	62.305	67.510	270.125	294.938
June	58.409	64.226	60.611	67.466	268.352	296.006
July	61.365	62.625	63.091	64.110	282.102	288.690
August	63.875	63.523	65.260	64.431	293.690	293.193
September	66.535	60.735	68.895	61.490	306.273	280.432
October	68.225	57.560	70.245	58.450	312.548	264.631
November	68.667	57.089	70.630	57.641	309.284	262.591
December	66.635	.....	68.514	.....	306.994	.....
Year	63.615	.....	65.285	.....	291.016	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1926	1927	1926 Spot	1926 3 Mos.	1927 Spot	1927 3 Mos.
January	8.304	6.661	38.059	37.363	30.979	30.938
February	7.759	6.673	36.053	35.956	29.931	30.109
March	7.332	6.692	34.090	34.247	30.649	30.889
April	7.001	6.338	32.503	32.863	29.579	29.901
May	6.821	6.075	32.038	32.413	29.034	29.131
June	7.112	6.213	33.244	33.398	28.598	28.613
July	7.411	6.229	34.045	34.270	28.280	28.021
August	7.376	6.342	34.173	34.524	28.210	28.068
September	7.413	6.212	34.389	34.415	27.347	27.327
October	7.296	5.996	34.256	34.146	26.899	26.634
November	7.199	5.745	33.491	33.483	26.281	26.006
December	7.018	.....	32.915	32.895	.....	.....
Year	7.337	.....	34.105	34.164	.....	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) Refined New York		Platinum (c) Crude New York	
	1926	1927	1926	1927	1926	1927	1926	1927
Jan.	23.490	13.910	87.960	101.200	118.200	109.520	113.200	99.820
Feb.	21.676	14.509	87.580	101.727	113.909	107.545	108.341	99.295
March	19.708	12.801	88.194	110.259	112.000	108.000	106.278	100.426
April	17.462	14.166	89.769	123.250	111.538	101.885	103.731	91.865
May	12.170	12.975	91.365	123.900	108.960	84.680	102.900	75.000
June	11.106	12.447	91.346	118.096	111.000	72.000	106.615	62.500
July	14.490	11.880	90.163	119.880	114.692	72.000	109.000	61.520
Aug.	15.957	11.826	89.260	119.111	116.000	72.000	108.692	62.000
Sept.	15.325	11.073	91.425	119.640	116.840	72.000	108.600	62.000
Oct.	13.943	11.165	97.260	126.200	112.240	72.000	106.000	62.000
Nov.	13.385	10.763	99.000	127.708	112.000	72.000	105.250	62.000
Dec.	13.142	.....	99.510	.....	111.846	.....	105.385	.....
Year	15.988	.....	91.903	.....	113.269	.....	106.999	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. Prior to June, 1927, the unit had been the 75-lb. flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh; and Aluminum, 98 Per Cent

	Bessemer		Basic		No. 2 Foundry		Aluminum	
	1926	1927	1926	1927	1926	1927	1926	1927
Jan.	22.76	21.04	21.76	20.01	22.26	20.26	27.000	26.270
Feb.	22.76	20.76	21.76	19.76	22.26	20.26	27.000	26.000
March	22.76	21.15	21.76	20.33	22.26	20.26	27.000	26.000
April	21.38	21.26	20.66	20.49	21.05	20.26	27.000	26.000
May	21.12	20.94	19.76	19.96	20.76	20.26	27.000	26.000
June	20.76	20.66	19.76	19.62	19.80	20.11	27.000	26.000
July	20.44	20.26	19.26	19.26	19.49	19.76	27.000	26.000
Aug.	19.87	20.07	19.18	19.01	19.26	19.40	27.000	26.000
Sept.	20.11	19.96	19.26	19.04	19.30	19.46	27.000	26.000
Oct.	20.76	19.76	19.76	18.76	19.97	19.26	27.000	25.600
Nov.	21.90	.....	20.46	.....	20.96	.....	27.000	25.000
Dec.	21.26	.....	20.26	.....	20.53	.....	26.934	.....
Year	21.31	.....	20.29	.....	20.64	.....	26.955	.....

Iron in dollars per long ton. Aluminum in cents per lb., 98 per cent grade.

Monthly Crude Copper Output in Short Tons

Domestic

	1927					
	April	May	June	July	Aug.	Sept.
Alaska shipments	2,121	3,045	2,105	2,798	2,138	1,879
Butte & Superior	.....	.....	†453	.....	.....	†284
Calumet & Arizona	1,711	2,422	2,075	1,866	2,577	1,807
Magma	1,232	1,270	1,250	1,066	1,182	1,196
Miami	2,295	2,346	2,176	2,233	2,268	2,008
New Cornelia	2,630	2,776	2,895	2,496	3,039	3,137
Nevada Con.	.....	.....	†27,821	.....	.....	.....
Old Dominion	879	1,030	815	825	850	931
Phelps Dodge††	8,063	7,972	8,085	7,706	7,366	7,779
United Verde Extension	1,630	2,051	1,768	1,868	1,905	1,813
Utah Copper	.....	.....	†30,028	.....	.....	.....
Tennessee Copper	410	433	390	408	445	412

Foreign

Andes Copper Mining Co.	.....	.....	2,495	2,370	2,367	2,367
Braden	7,164	7,565	7,447	8,986	8,995	8,991
Boleo, Mexico	550	1,017	1,115	1,215	1,067	852
Bwana M'Kubwa	360	515	464	337	366	336
Chile	9,352	9,791	8,988	9,005	9,020	...
Furukawa, Japan	1,416	1,493	1,569	1,367	1,461	1,549
Granby Cons., Canada	2,123	2,989	2,287	2,261	2,261	2,268
Mount Lyell, Aust.	.....	.....	†1,423	.....	.....	†1,515
Sumitomo, Japan	1,388	747	.....	1,693	1,338	..760
Union Miniere, Africa	6,039	7,050	7,004	8,065	8,008	9,075

†Three months.
††Moctezuma is included.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1925		1926		1927	
	Monthly Production	Daily Rate	Monthly Production	Daily Rate	Monthly Production	Daily Rate
January	74,789	2,412	71,026	2,291	76,198	2,458
February	68,967	2,463	68,131	2,433	69,202	2,472
March	74,901	2,416	75,728	2,443	69,314	2,236
April	70,667	2,356	73,454	2,448	71,122	2,371
May	70,574	2,276	73,542	2,372	71,613	2,310
June	59,894	2,330	71,317	2,377	69,539	2,318
July	68,507	2,210	72,278	2,330	65,545	2,114
August	68,090	2,196	72,014	2,323	67,248	2,169
September	67,720	2,272	72,672	2,421	65,936	2,198
October	71,042	2,292	75,099	2,423	68,828	2,220
November	67,400	2,247	74,947	2,498	.....	.....
December	69,566	2,244	72,205	2,329	.....	.....
Total	842,117	.....	872,509	.....	694,545	.....
Monthly average	70,176	.....	72,709	.....	69,455	.....
Average of daily rate	.....	2,307	.....	2,390	.....	2,285

Mining Stocks—Week Ended November 26, 1927

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	53¼	50⅜	52⅜	Oc.15, No.21 Q	0.75
Arcadian Consol.	Boston	1⅛	1⅛	1⅛		
Ariz. Com'l	Boston	6	5⅛	5⅛	Jy. 18, Jy. 30	0.25
Calaveras	N. Y. Curb			1⅛		
Calumet & Arizona	New York	98⅜	93¼	96¼	De. 3, De. 9 Q	1.50
Calumet & Hecla	Boston	19½	18⅜	19	No. 30, De.15 Q	0.50
Cerro de Pasco	New York	67	64	67	Oc.13, No.1 Q	1.00
Chile Copper	New York	38⅜	37¼	38¼	De. 2, De. 30 Q	0.62½
Con. Coppermines	N. Y. Curb	4⅛	4¼	4⅜		
Copper Range	Boston	16⅛	16	16⅛	Ap.2, My.2, A	1.00
Crystal Copper	BostonCurb	*45	*30	*44		
East Butte	Boston	2½	2	2 2/16	Dec. 1919	0.50
Granby Consol	New York	37½	36½	37⅛	Jn.15 Jy. 1 Q	1.00
Greene Cananea	New York	90⅛	82	88½	Nov., 1920	0.50
Howe Sound	New York	44⅜	39½	43⅜	Oc.1, Oc.15, Q	1.00
Inspiration Consol	New York	21	19⅜	20	Ma.17, Ap.4, Q	0.25
Iron Cap	Boston Curb	2⅜	2⅛	2⅜		
Isle Royale	Boston	13½	12⅛	13	Se. 30, Oc. 15 Q	0.50
Kennecott	New York	82⅛	80½	82	De. 2, Ja.3 Q	1.25
Magma Copper	New York	51⅛	48½	50½	Se.30,Oc.15 Q	0.75
Mason Valley	N. Y. Curb			*85		
Miami Copper	New York	16⅛	16	16⅛	No.1, No.15, Q	0.37½
Mohawk	Boston	49⅜	47	49⅜	Oc.31, De.1 Q	2.00
Mother Lode Coal	New York	2⅛	2	2⅛	Jn.10, Jn.30	0.25
Nevada Consol	New York	17⅜	17⅛	17⅜	Se. 16, Se. 30 Q	0.37½
New Cornelia	Boston	26	25	25⅝	No.4, No.21 Q	0.50
Noranda	N. Y. Curb	26⅛	24½	25½		
North Butte	Boston	1⅛	1	1 1/16	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*96	*81	*89	Sept. 1926	0.03
Old Dominion	Boston	12½	12	12	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	127	120½	127	De.17, Ja.3 Q	1.50
Quincy	Boston	16⅛	14	14⅜	March, 1920	1.00
Ray Consolidated	New York			15½	Ap.20, Ap. 30	0.25
St. Mary's Min. Ld.	Boston	29	27½	27⅞	Fe.10, Ma.10	2.00
Seneca Copper	New York	1⅛	1⅛	1⅛		
Shattuck-Denn	Boston Curb	13	7⅞	11		
Tenn. C. & C.	New York	10⅛	9⅜	10	No.30, De.15, Q	0.12½
United Verde Ex	N. Y. Curb	29⅞	27⅛	29⅛	Oc.6, No.1 Q	0.75
Utah Copper	New York			130	Se. 16, Se. 30 Q	1.50
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	*51	*45	*51		
NICKEL-COPPER						
Internat. Nickel	New York	68⅛	66½	67⅞	Se. 16, Se. 30 Q	0.50
Internat. Nickel pfd.	New York			108	Oc. 13, No. 1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*15	*14	*15	June, 1927	0.005
National Lead	New York	135	125	132½	De. 16, De. 31 Q	1.25
National Lead pfd	New York			112⅜	Ja.13, Fe. 1 Q	1.50
St. Joseph Lead	New York	38⅞	36⅛	38⅜	De.10,De.20,QX	0.75
ZINC						
Am. Z. L. & S.	New York	7⅛	6⅛	7⅛	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	39⅛	37	38⅛	Nov., 1920	1.50
Butte C. & Z.	New York	4⅛	4	4⅛	De. 9, De. 24	0.50
Butte & Superior	New York	10⅛	9	9⅛	Se. 16, Se. 30 Q	0.50
Callahan Zn-Ld	New York	1⅜	1⅜	1⅜	Dec., 1920	0.50
Consol.Lead&Zinc'A'	St. Louis	12	11⅛	12	Ma.15, Ap.1 Q	0.25
Eagle-Picher	Cincinnati	24⅛	23⅞	23⅞	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati			117⅛	Jn.30, Oc.15 Q	1.50
New Jersey Zn	N. Y. Curb	185	182	183⅛	No. 19, De. 10 X	2.00
United Zinc	N. Y. Curb			*55		
Yellow Pine	Los Angeles	*40	*40	*40	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Argonaut	Toronto	*47½	*35½	*38		
Barry-Hollinger	Toronto	1.50	1.15	1.26		
Con.W.Dome L.new.	Toronto	*18	*15	*16		
Cresson Consol. G	N. Y. Curb	1⅛	1⅛	1⅛	Se. 30, Oc.10 Q	0.10
Dome Mines	New York	14⅛	11⅛	13⅛	Se.30, Oc.20 Q	0.75
Golden Cycle	Colo.Springs	†1.70	†1.67		No.30, De.10 Q	0.04
Hollinger Consol.	Toronto	17.50	17.25	17.50	No. 16, De. 2	0.10
Homestake Mining	New York	70	70	70	No.19, No.25 M	0.50
Kirkland Lake	Toronto	2.76	2.48	2.65		
Lake Shore	Toronto	27.70	26.00	26.05	De 1, De.15 QX	0.20
McIntyre-Porcupine	New York	27⅛	27⅛	27⅛	De.1, De.15 Q	0.10
Portland	Colo.Springs	†*30½	†*28		Ap.6, Ap.15, Q	0.02
Rand Mines	New York			48⅛	Au.22-29 Am.Sh.	1.52
Teck-Hughes	Toronto	12.00	11.00	11.45	Jy.21, Au.1	0.10
Tom Reed	Los Angeles	*27½	*27½	*27½	Dec., 1926	0.02
Tough-Oakes	Toronto	*82	*65	*79½		
United Eastern	N. Y. Curb	*45	*45	*45	July, 1924	0.05
Vipond Cons	Toronto	1.15	*82½	*88	Apr.1, Apr.15	0.03
Wright-Hargreaves	Toronto	7.50	7.00	7.12	Oc.17, No.1	0.05
GOLD AND SILVER						
Carnegie Metals	Pittsburgh			12		
Con. Cortez	N. Y. Curb			*20		
Dolores Esperanza	N. Y. Curb	*42	*42	*42	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅜	2⅛	2⅛	Se. 15, Oc. 4	0.08
Tonopah Belmont	N. Y. Curb			1	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb	*15	*12	*13	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	2	2	2	Se 20, Oc.21	0.07½
West End Consol	N. Y. Curb	*2	*2	*2	Mar., 1923	0.05
Yukon Gold	Boston Curb	*75	*70	*70	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	2.25	2.10	2.11	May, 1920	0.03
Castle-Trethewey	Toronto	*90	*84	*90		
Coniagas	Toronto	4.75	4.50	4.50	May, 1924	0.12½
Keeley	Toronto	*90	*78	*78	Se.1, Se.15	0.08½
Lorrain Trout Lake	Toronto			*60	July, 1925	0.05
McKinley-Dar.-Sav.	Toronto	*18⅛	*18	*18⅛	Oct., 1920	0.03
Mining Corp. Can	Toronto	4.85	4.20	4.60	Jn. 29, Jy.15	0.12½
Nipissing	N. Y. Curb	6⅛	6⅛	6⅜	Se.30, Oc.20 Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅜	3⅛	3⅛	Ma. 25,Ap.4,QX	0.12½
Bingham Mines	Boston	58	57⅞	58	Se.24, Oc.5 Q	1.00
BunkerHill&Sullivan	N. Y. Curb	133	131	133	Oc. 31, No.4	0.75
Cardiff M. & M.	Salt Lake	*67	*62	*67	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	2.10	2.10	2.10	Nov., 1926 Q	0.10
Consti'nMng.&Mill'g	Spokane	*16	*15	*16		
Erupcion	Boston Curb	*50	*49	*50	Se. 15, Oc.3 Q	0.07½
Eureka Lily	Salt Lake	1.25	1.12½	1.17½		
Federal M. & S.	New York			144	Jn.25, Jn.29 Spec.	$10
Federal M. & S pfd.	New York	96½	94½	94½	No. 12 De 15 Q	0.25
Hecla Mining	N. Y. Curb	16⅛	16	16⅛	No.15, De.15 Q	1.75
Highland-Surprise	Spokane	*11½	*11	*11		
Iron King Mining	Salt Lake	*49½	*49½	*49½		
Keystone Mining	Salt Lake	†*25	†*18		Au. 12, Au. 26	0.07½
Lucky Jim	Spokane	*26½	*26	*26		
Lucky Tiger-Com	Kansas City	†7.15	†7.00		Oc.10, Oc. 20	0.05
Mammoth Mining	Salt Lake	1.90	1.90	1.90	Jn.10, Jn.20 Q	0.05
Marsh Mines	Spokane	1.50	1.37½	1.50		
North Lily	Salt Lake	3.45	3.35	3.42½		
Park Utah	New York	7⅛	7⅛	7⅛	Se. 15, Oc. 1 Q	0.20
Plutus Mining	Salt Lake			1.40	Oc. 25, No. 10 Q	0.10
San Rafael	San Fran.	*11⅛	*9½	*9½		
Silver King Coal	Salt Lake	10.00	9.90	10.00	Se. 20, Oc. 1 Q	0.25
Silversmith	Spokane	*16½	*15½	*16	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*49	*46	*49		
Sunshine M. Co.	Spokane	1.17	1.15	1.15		
Tamarack-Custer	Spokane	*43½	*39½	*43½	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.75	12.75	12.75	Se.15, Se.29 QX	0.40
Utah-Apex	Boston	4⅛	4⅛	4⅛	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	55⅞	54⅜	55⅜	Se. 2, Oc. 1.	1.75
Cleveland-Cliffs Iron	Cleveland	110	98⅛	100	Oc. 15, Oc. 25 Q	1.00
Colorado Fuel & Iron	New York	79⅜	74	78	May, 1921	0.75
Gt. North'n Iron Ore	New York	24⅛	23⅛	23⅛	Dec. 6, Dec. 28	0.75
Inland Steel	New York	53⅞	51⅛	53⅛	No. 15, De. 1 Q	0.62½
Replogle Steel	New York			12⅜		
Republic I. & S.	New York	63⅛	60⅛	61⅛	No. 15, De.1 Q	1.00
Republic I. & S. pfd.	New York	102	101⅛	102	De. 14, Ja. 2 Q	1.75
Sloss-Sheffield S. & I.	New York			117	De. 10, De. 20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	109½	109⅛	109½	De. 20, Ja.3 Q	1.75
U. S. Steel	New York	147⅞	141⅛	147	No. 30, De. 30 Q	1.75
U. S. Steel, pfd.	New York	137⅞	136½	137⅜	Oc.30, No. 29 Q	1.75
Virginia I. C. & C.	New York			36⅛	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York			60⅛	De. 16, Ja. 3	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York			27½	Jn. 26, Jn.30	1.45
So. Am. G. & P. New.	N. Y. Curb	2⅛	2⅛	2⅛		
Alum. Co. of Amer	N. Y. Curb	140	105	138		
Alum. Co. of Amer.pf.	N. Y. Curb	104½	104½	104½	Se. 15, Oc 1 Q	1.50
Vanadium Corp	New York	58½	54⅛	57⅞	No. 1, No. 15 Q	0.75
Patino M. & E.	New York	22⅞	19⅜	22⅛	Ap. 27, My. 5	1 sh.
ASBESTOS						
Asbestos Corp	Montreal	37	35	35⅜	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	95	94	94	Se.30, Oc.15 Q	1.75
SULPHUR						
Freeport, Texas	New York	98⅜	95⅜	96	Oc.15, No.1 QX	1.50
Texas Gulf	New York	74⅛	72	72⅜	De. 1, De. 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	42⅛	41¼	41½	No.19, De.1 Q	0.75
Amer. Metal, pfd	New York			110	No.19, De.1 Q	1.75
Amer. Sm. & Ref.	New York	176	171⅜	175⅜	Oc.14, No. 1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	131⅛	131	131⅛	No., Dec. Q	1.75
Consol. M. & S.	Montreal	256½	250	253	Jn. 30, Jy. 15 X	6.25
Newmont Mining	N. Y. Curb	128⅜	114½	126½	Se.30, Oc.15 Q	1.00
U. S. Sm. R. & M.	New York	42⅛	40	42⅜	Oc. 6, Oc. 15 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	49⅜	49	49⅜	Oc. 6, Oc. 15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

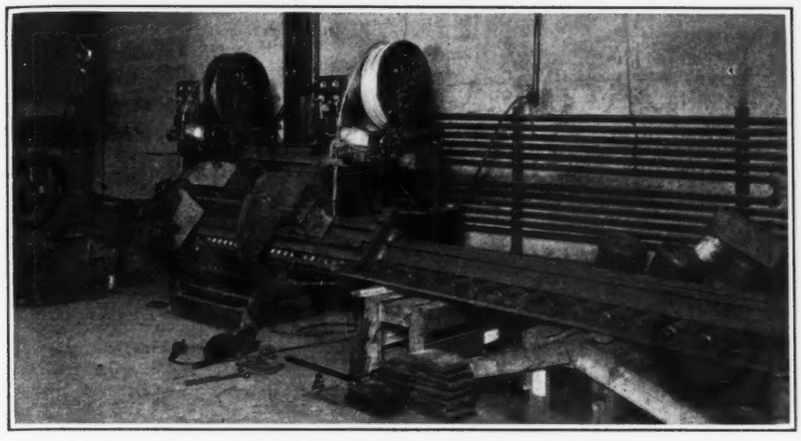
Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED NOV. 15, 1927

Name	High	Low	Last	Date	Amount	Last Div.
Aramayo Mines (25 frs.)	75/7½	75/—	75/—	Nov., 1927	5	p.c. (†)
British Platinum (£1)	—/9	—/6	—/9	Feb., 1925	2½	p.c.
Burma Corpn. (10 rupees)	13/7½	13/—	13/1½	Aug., 1927	6	annas*
Bwana M'Kubwa (5s)	4/4½	3/10½	4/—			
Camp Bird (2s)	3/6	3/1½	3/6			
El Oro (£1)	4/1½	3/9	4/1½	Nov., 1924	2½	p.c.*
Esperanza (10s)	—/2	—/2	—/2			
Frontino & Bolivia (£1)	14/1½	13/1½	13/9	July, 1927	5	p.c
Mexican Corpn. (£1)	9/—	8/6	9/—			
Mexico Mines of El Oro (£1)	20/—	16/3	18/9	Dec., 1926	3½	p.c.*
N'Changa Copper Mining	11/6	11/—	11/6			
Oroville Dredging (£1)	6/7½	6/—	6/3	Dec., 1923	3¾	p.c.
Ouro Preto (£1)	2/6	2/—	2/6	May, 1925	2½	p.c.
Rhodesian Congo Border (£1)	41/—	38/9	40/—			
St. John del Rey (£1)	10/1½	9/7½	10 —	May, 1927	3¾	p.c.
San Francisco Mines (10s)	28/—	27/3	27/9	July, 1927	15s.	
Santa Gertrudis (£1)	17/7½	17/1½	17/3	July, 1927	7½	p.c
Selukwe (2s. 6d.)	7/3	6/9	7/—	April, 1917	6¾	p.c
S. Amer. Copper (2s.)	2/6	2/1½	2/3	Nov., 1917	75	p.c.
Tanganyika (£1)	64/1½	57/6	63/1½	Aug., 1927	7½	p.c.
Union Miniere du Haut-Katanga (Brussels)	10.200	9.950	10.200	July, 1927	182.60	(‡)

* Free of British income tax. † Swiss francs and plus 15 p. c. bonus. ‡ Belgian frs. and free of taxation.

Industrial Progress



Automatic arc-welding machine for welding metal railroad ties constructed from scrap rails

Railroad Ties Made From Scrap Rails by Automatic Welding Machine

AUTOMATIC welding equipment for making metal railroad ties from scrap rails has been introduced by the General Electric Company. With it, railroads can make their own metal ties, or manufacturers can build them for sale. The development of this machine followed the discovery by William Dalton, announced earlier this year, that such a railroad tie was practicable.

The metal railroad tie has advantages over the wooden tie in that it possesses longer life and greater strength. It is of simple construction and can be made in an automatic welding machine at low cost. One of the ties is shown in the accompanying illustration.

The new welding apparatus developed for this work consists of an automatic tie-welding machine and a 1,500-amp. motor-generator set with two circuits for hand welding and two circuits for automatic welding. The following equipment is required:

A section of a roller conveyor on which the rails are moved into position for welding.

A jig for correctly spacing the rails and locating the tie plates on top of the rails.

Two pneumatic plungers for rigidly holding these parts in position.

A pair of spring- and toggle-operated clamps for holding the angle irons against the ends of the rails.

A mechanism which rotates the whole jig with its rails and plates. This turns in either direction a distance of 45 deg. from the perpendicular, permitting automatic welding to be done first on one side of the tie plate and then on the other.

Two automatic welders mounted on individual travel carriages for welding the two tie plates simultaneously.

A track on which the travel carriages ride.

A supporting framework.

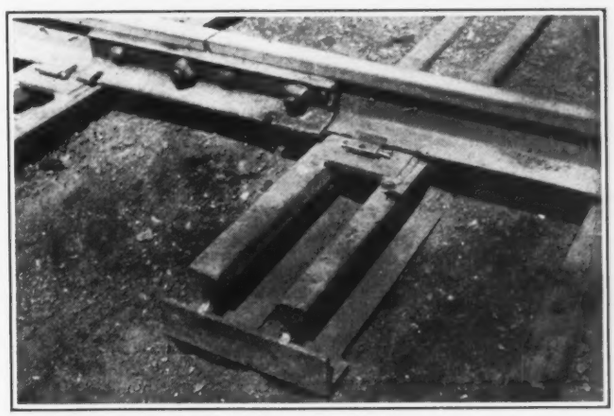
Each metal tie consists of two lengths of worn or scrap rail cut to length and held together at both ends by angle bars which are welded to the rails. The rails are further held together by two tie plates which are welded to the top or head of the rails at the point where the track work is clamped to the tie. The tracks are clamped to the tie plates by means of rail clamps and spring steel keys.

The actual operation of the tie welding machine is carried out as follows:

The rails are inserted into the machine and the tie plates placed in position. Then the equipment is fixed in position by means of compressed air. The angles are next placed in position, after which the work is rotated to a point where the joints between the plates and one rail may be welded. Following the last-mentioned operation, the first welds are made automatically, the arcs moving away from each other. The fixture is then rotated to a point where the other joints are beneath the electrode and the welds are made with electrodes moving toward each other.

While the automatic welds are being made, the operator welds the angles to the ends of the rails by hand welding. All welding being completed, the fixture is turned back to normal position and the completed tie removed.

For maximum production, the machine requires two operators, one for each of the two automatic heads. Each head has a separate control panel, thus making each operator largely independent of the other. The output of the machine with two operators is estimated at one tie every five minutes.



Arc - welded metal railroad tie made out of scrap rail, in actual use

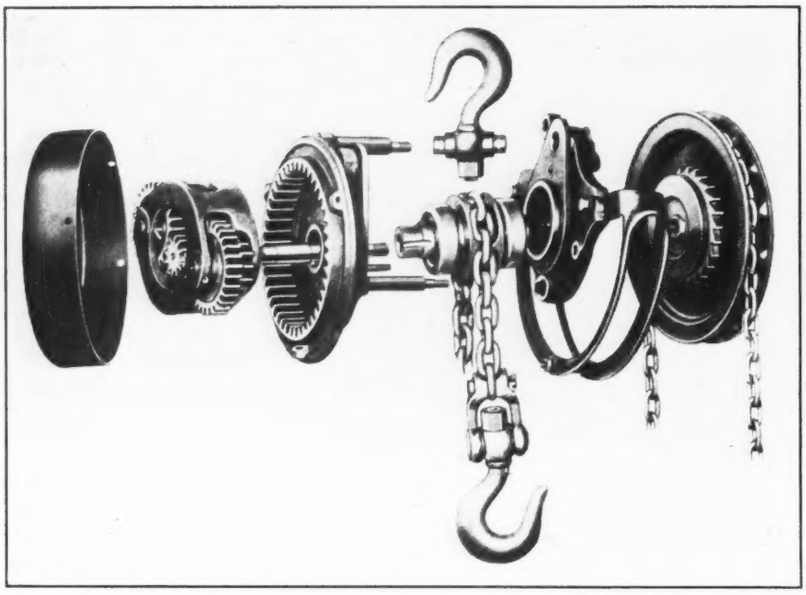
A Spur-Geared Chain Hoist

THE illustration on page 920 shows the parts, disassembled, of the spur-geared ball-bearing chain hoist that has been introduced by the Dickerman Hoist Manufacturing Company of Cleveland. This hoist, which is known as the "Ideal," is adapted for a wide variety of industrial service.

The gear arrangement in the hoist is of the planetary type, the word "planetary" being used because of the similarity of the rotating movement of gears around a central pinion to the revolving movement of planets in a solar system around the sun. The function of each part shown in the illustration is as follows:

An endless hand chain—sometimes called operating chain—passes over a hand wheel which turns on the screw hub of a ratchet friction disk which is keyed to a one-piece drive shaft and pinion. This pinion meshes with two gears held diametrically opposite each other in a pinion cage which is secured, by double keys, to the load wheel that carries the chain. Integral with these gears are intermediate pinions that mesh with a large internal gear and serve as a fulcrum to rotate the planetary gear.

A pull on either side of the hand-chain loop causes the drive pinion to rotate the gears in opposite directions, thus causing their pinions to travel around the internal gear revolving the pinion



Parts of new spur-geared chain hoist disassembled

cage and load wheel, thereby raising or lowering the load. When the pull on the hoisting side of the hand-chain loop is discontinued, a pawl engages the ratchet disk, preventing the load from lowering.

A pull on the lowering side of the hand chain unscrews the hand-chain wheel from the hub of the ratchet disk, thus releasing the drive shaft and permitting the weight of the load to rotate the planetary gear. The downward speed of the load is always in ratio to the rapidity with which the operator overhauls the hand chain. The lowering movement continues until the pull on the lowering side of the hand-chain loop ceases, when the revolving of the ratchet disk causes it to again screw into the hand chain wheel.

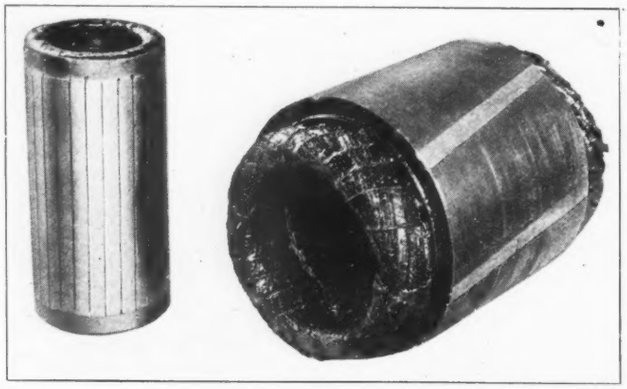
Capacities of over ten tons can be obtained with two gear trains in separate gear cases connected by a yoke and operated by separate hand chains, but with a single hoisting hook.

New Shell Type Motor of Welded Design

A SQUIRREL-CAGE MOTOR for use with machinery requiring high-speed motors has been developed by the Lincoln Electric Company, of Cleveland, Ohio. It is of the so-called shell type, an all-welded design, and is made to standard dimensions. It is supplied in two sizes, 3 and 5 hp. The 3-hp. unit has an external diameter of 6.5 in. and an external length of 4.5 in. The 5-hp. motor is of the same diameter and is 6 in. in external length. Both motors are made for either two- or three-phase, 60-cycle current and a speed of 3,600 r.p.m. The stator is composed of laminated sections arc-welded together. Welding is done while the shell is under pressure and is placed in six transverse slots. The rotor is also entirely arc-welded and provided with either a straight or tapered bore.

A definite advantage is claimed for this type of construction in that the welding does away with the necessity of a solid shell about the laminations and also replaces the conventional rivets. Thus the amount of active field is kept at a maximum. The effect of this is to increase the magnetic flux and allow more copper to be used in the slot. Greater magnetic flux assures better operating characteristics. This increase of copper makes for a cooler-running motor and permits greater overload.

As normally used the stator is secured in the frame of the machine and the rotor is mounted on the tool shaft. If desired, the stator can be supplied with 6-ft. leads.

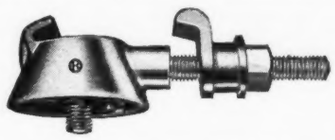


Stator and rotor of new welded shell-type motor

New I-Beam Hanger for Mine Trolley Lines

AN INSULATED I-beam hanger is now being produced by the Ohio Brass Company, of Mansfield, Ohio, in which, according to the company, a new idea has been incorporated. The hanger is for use in suspending trolley lines on I-beam roof supports, and, unlike other apparatus of the sort, is a two-way device, being a handy, compact combination of hanger and clamp. Its use will, it is claimed, result in substantial economies for the mine operator, for two reasons. First, the labor cost for installation is much less than that for installing other clamps, owing to the fact that it eliminates the double operation necessary in installing the old-fashioned clamps. To install the new hanger it is necessary simply to hook it over the edges of the I-beam and tighten the holding nut. Second, the decreased volume of materials used in its construction results in a saving in the cost price as compared with that of bulkier devices.

Insulation provided is of the usual O-B Dirigo variety, used in making all O-B devices needing such treatment. This insulation is known to yield a high degree of dielectric and mechanical strength, and possesses successful acid-



A trolley hanger embodying a new idea

resisting properties also. The hanger shell and clamp are made of the company's Flecto hot-dip galvanized iron.

The new hanger is made to fit I-beams or rails with a bottom width of 3 to 5 in. It may also be had, on order, in special sizes to fit roof supports smaller than 3 in. and larger than 5 in.

CATALOGS

BOILER PLANT — Atlas Valve Company, 282 South St., Newark, N. J. The Campbell boiler feed water regulator. A four-page bulletin; illustrated.

BLOWERS, COMPRESSORS, ETC. — De Laval Steam Turbine Company, Trenton, N. J. Bulletin E-1107, covering compressors, pumps, turbines, and speed reducers for blast furnaces, steel plants, and byproduct coke-oven plants. Pages, 16; illustrated.

FLOODLIGHT PROJECTORS — Crouse-Hinds Company, Syracuse, N. Y. Folder No. 46, covering floodlight projectors. Illustrated.

PLANE BIT—Horace Hills, Inc., Room 1535, 315 Montgomery St., San Francisco. A leaflet describing a removable plane bit, known as the Basmaison ever-sharp plane bit. Pages 4; illustrated.

LIME KILNS—Steacy-Schmidt Manufacturing Company, York, Pa. Bulletin No. 23, covering Keystone lime kilns. Pages, 8; illustrated.